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THE SHREWS OF NIGERIA  
(MAMMALIA: SORICIDAE)

by

R. HUTTERER and D. C. D. HAPPOLD

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## INTRODUCTION

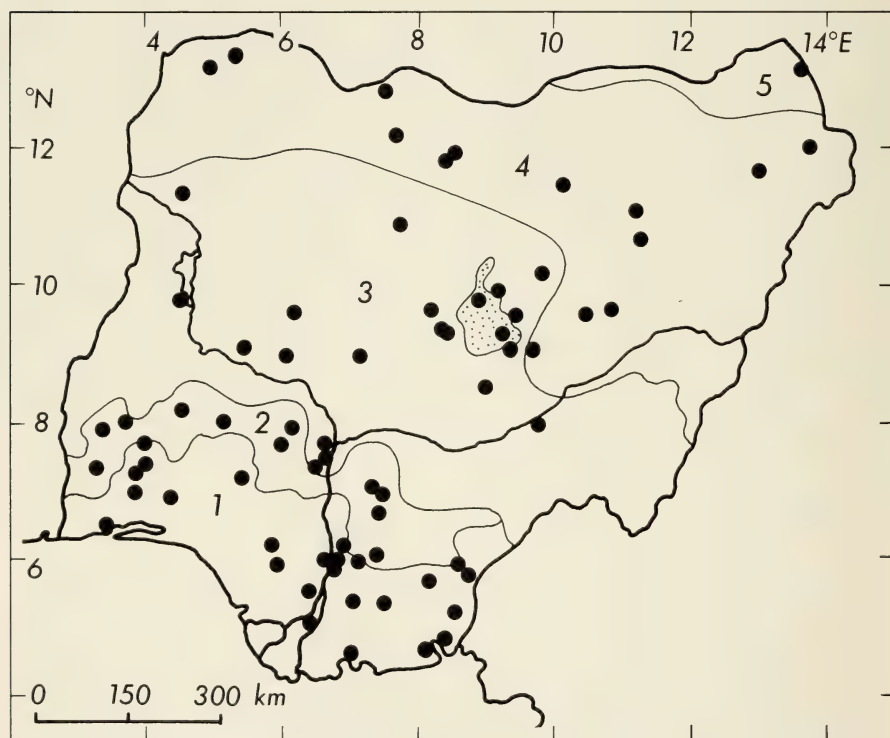
The shrews (Soricidae) are one of the least studied families of West African mammals. This is because they are generally uncommon and rarely encountered, all rather similar in form and structure, and difficult to identify. Most published works have been confined to taxonomic descriptions of (supposedly) new species and subspecies, often based on very few specimens. Ecological, physiological and behavioural studies on West African shrews are very scarce. Similarly, no attempt has been made in recent years to describe all the species of shrews known from any West African country. This paper, therefore, is an attempt to provide a comprehensive survey, within the limits of our present knowledge, of all the shrews known from Nigeria.

An understanding of the variety and number of species of shrews in Nigeria requires some knowledge of the environment and vegetation zones of the country. There is considerable similarity in the climate, vegetation zones and degree of seasonality in all the countries of West Africa. The vegetation zones run parallel to each other along the lines of latitude, and therefore there is continuity of habitat and vegetation between Nigeria and its neighbouring countries (Map 1). Nigeria has an area of 923 773 km<sup>2</sup> (356 669 square miles), and extends between latitudes 4,20° N and 13,50° N. The rainforest zone in the south is characterised by tall rainforest trees, an annual rainfall of 1300—4000 mm extending over 9—12 months of the year, and limited seasonality. North of the rainforest are successive savanna zones, each of which varies in floristic composition. Sudan and Sahel savannas in the north have sparse woodlands and grasslands, an annual rainfall of 250—1000 mm extending over 3—6 months of the year (depending on the latitude), and very marked seasonality. Guinea and derived savannas are intermediate in characteristics. Extensive areas of the savanna zones are dry for much of the year and probably do not provide suitable habitats for shrews. In contrast, localised floodplains, fadamas, riverine and relic forests, inselbergs, and perhaps termittaria provide microenvironments and cover as well as a more-or-less continuous supply of potential prey. The limited number of optimum habitats for shrews is one of the reasons why they are seldom encountered and rarely collected.

The number of species and geographical distribution of Nigerian shrews may be inferred, to some extent, from the species described from similar environments in other West African countries. Rosevear (1941) listed 11 species in Nigeria, and Cozens and Marchant (1952) recorded two species from Owerri Province in the south-east of the country. Later Rosevear (1953) published locality records and distribution maps for 13 species. Since then, the taxonomic status of some of these species has changed, and the Cameroon and Bamenda Provinces of Nigeria have become part of the Republic of Cameroun. Other works which describe, or list, West African shrews (Dollman 1915, Heim de Balsac & Barloy 1966, Heim de Balsac 1968, Heim de Balsac & Meester 1977) do not necessarily mention whether a particular species occurs in Nigeria. Therefore, our knowledge of Nigerian shrews has been very incomplete and fragmentary. The mammalian fauna of Nigeria is extremely rich and diverse as a result of the size and va-

ried environments in the country (Happold, in press) and, as this paper shows, this is equally true for the shrews as for many other families of mammals.

During 1965—1982, many more specimens of Nigerian shrews have become available for study. Even so, shrews cannot be considered to be abundant. For example, they formed only 6,9 % ( $n = 538$ ) of small terrestrial mammals in a Nigerian rainforest (Happold 1977), and only 3 % in several savanna and rainforest habitats in western Nigeria (Happold 1975). Conversely, the incidence of shrew remains in owl pellets from Yankari reserve (Demeter 1978, 1981) suggests that shrews may not be uncommon in certain localities. The apparent scarcity of shrews may be due, in part, to the lack of adequate collecting techniques; most of the specimens have been obtained by live- and snap-trapping and, as far as we know, pitfall traps and plastic „walls” (Dieterlen 1967) have not been used in Nigeria or elsewhere in West Africa.



Map 1: Collecting localities and vegetation zones of Nigeria. The collecting localities (black circles) are unevenly distributed, with few records from the north-east and north-west of the country and along the Cameroun border. The five vegetation zones, from south to north are: 1. rainforest; 2. derived savanna; 3. Guinea savanna; 4. Sudan savanna; 5. Sahel savanna. Stippled area indicates 1000 m contour of the Jos plateau. Names and co-ordinates of collecting localities are given in the Gazetteer (page 76).



## MATERIALS AND METHODS

For this study, we have been able to examine 601 skins, and/or skulls, and specimens in alcohol, from the following sources:

1. Collections made by survey teams of the United States National Museum 'African Mammal Project' in all vegetation zones during 1965—1967 (189 specimens).
2. Collections made by one of us (DCDH) in the rainforest and savanna zones of western Nigeria during 1966—1976 (45 specimens).
3. Collections made by A. Demeter by trapping, and from the remains of shrews in owl pellets, at Zaria and Yankari GR during 1974 and 1978 (133 specimens).
4. Collections made by A. Meylan and B. Dobrokotov during the WHO Lassa Fever survey during 1977 and 1978 (39 specimens).
5. Collections made by L. Santini, Pisa, at localities near Port Harcourt during 1981 (23 specimens).
6. Collections made by C. Smeenk, formerly Game Warden, Pandam Game Reserve, at Toro during 1976 (25 specimens), now deposited in the Rijksmuseum van Natuurlijke Historie, Leiden.
7. Collections made by S. Churchfield in the Calabar District during 1981 (1 specimen).
8. Museum specimens from various museums as given below.

Locations of specimens examined during this study are as follows:

- |      |   |
|------|---|
| AD   | Collections by A. Demeter, now in the Natural History Museum, Budapest, Hungary. Part of this collection is also in BMNH and ZFMK.              |
| AM   | Collections by A. Meylan, to be deposited in the Muséum d'Histoire Naturelle, Genève, Switzerland.  |
| BMNH | British Museum (Natural History), London, England.  |
| DH   | Collections by D. C. D. Happold, Canberra (formerly University of Ibadan, Nigeria), now in the possession of the collector.                     |
| HNHM | Hungarian Natural History Museum, Budapest, Hungary.  |
| LS   | Collections by L. Santini (Entomological Institute, Pisa, Italy) now in the possession of the collector. A few reference specimens are in ZFMK. |
| NHI  | Natural History Museum, University of Ife, Ile-Ife, Nigeria.  |
| NMW  | Naturhistorisches Museum, Wien, Austria.  |
| RNHL | Rijksmuseum van Natuurlijke Historie, Leiden, The Netherlands.  |
| SC   | Collections by Sara Churchfield (University of London) now in the possession of the collector.  |
| SMNS | Staatliches Museum für Naturkunde, Stuttgart, Germany.  |

- USNM United States National Museum, Smithsonian Institution, Washington, D. C., USA.
- ZFMK Zoologisches Forschungsinstitut und Museum Alexander Koenig, Bonn, Germany.
- ZMB Museum für Naturkunde der Humboldt-Universität, Berlin, German Democratic Republic.
- ZMC Zoologisk Museum, Copenhagen, Denmark.

In the following account, we refer only to specimens seen by us, and have omitted published distribution records when no specimens have been available for verification. For each species, information is given on distribution, identification, natural history, taxonomy and locality records. Figures of skull and tooth characteristics, and distribution maps, are provided for most species. All skull figures were drawn by one of us (R. H.) with the aid of a Wild stereo microscope with attached camera lucida. Measurements are given in millimetres, weight data in grams.

Abbreviations in the text are: HB = Head and body length; T = Tail length; HF = Hindfoot length; E = Ear length; WT = Weight; CI = Condylar-incisive length of the skull; IW = Least interorbital width; MB = Maxillary breadth; GW = Greatest width

Table 1: List of species and accompanying chromosome numbers (after Meylan 1968, 1975, and Meylan & Vogel 1982). Chromosomal data for *manni*, *gracilipes* and *nigeriae* were taken from specimens collected in Nigeria.

<i>Sylvisorex megalura</i> Jentink, 1888)	2N = 48	NF = 96
<i>Suncus etruscus</i> (Savi, 1822)	42	74
<i>Suncus varilla</i> (Thomas, 1895)	—	—
<i>Crocidura bottegi</i> Thomas, 1898	40	60
<i>Crocidura butleri</i> Thomas, 1911	—	—
<i>Crocidura buettikoferi</i> Jentink, 1888	—	—
<i>Crocidura crossei</i> Thomas, 1895	44	66
<i>Crocidura dolichura</i> Peters, 1876	—	—
<i>Crocidura douceti</i> Heim de Balsac, 1958	—	—
<i>Crocidura (flavescens) manni</i> Peters, 1878	50	66
<i>Crocidura foxi</i> Dollmann, 1915	—	—
<i>Crocidura fulvastra</i> (Sundevall, 1843)	—	—
<i>Crocidura fuscomurina</i> (Heuglin, 1865)	—	—
<i>Crocidura cf. gracilipes</i> Peters, 1870	52	86
<i>Crocidura grandiceps</i> Hutterer, 1983	46	68
<i>Crocidura lamottei</i> Heim de Balsac, 1968	—	—
<i>Crocidura longipes</i> new species	—	—
<i>Crocidura lusitania</i> Dollman, 1915	—	—
<i>Crocidura nigeriae</i> Dollman, 1915	50	76
<i>Crocidura odorata</i> (Leconte, 1857)	50	66
<i>Crocidura planiceps</i> Heller, 1910	44	72
<i>Crocidura poensis</i> (Fraser, 1843)	52	70
<i>Crocidura viaria</i> (I Geoffroy Saint-Hilaire, 1834)	—	—
<i>Crocidura yankariensis</i> Hutterer & Jenkins, 1980	—	—

of the skull; HCC = Height of braincase; UTR = Length of upper toothrow. Our nomenclature for the skull mostly follows Meester (1963), and colour descriptions were based on the colour plates of Ridgway (1912).

For easy reference, Table 1 lists the 24 species of shrews now known to occur in Nigeria, with the chromosome numbers for some species. Table 2 lists the shrews according to their average head and body lengths and shows whether each species is primarily a rainforest or a savanna living species.

Table 2: Head and body lengths of rainforest and savanna shrews (genera *Sylvisorex*, *Suncus* and *Crocidura*)

Average HB (mm)	Rainforest Zone	Savanna Zones
30—40	—	<i>Suncus etruscus</i>
40—50	<i>Crocidura bottegi</i>	<i>Suncus varilla</i>
		<i>Crocidura fuscomurina</i>
50—60	<i>Crocidura dolichura</i>	<i>Crocidura douceti</i>
		<i>Crocidura planiceps</i>
		<i>Crocidura yankariensis</i>
		<i>Sylvisorex megalura</i>
60—70	<i>Crocidura crossei</i>	<i>Crocidura lusitania</i>
70—80	<i>Crocidura buettikoferi</i>	<i>Crocidura gracilipes</i>
80—90	—	<i>Crocidura butleri</i>
90—100	<i>Crocidura poensis</i>	<i>Crocidura foxi</i>
		<i>Crocidura fulvastra</i>
		<i>Crocidura lamottei</i>
		<i>Crocidura viaria</i>
100—110	<i>Crocidura nigeriae</i>	<i>Crocidura longipes</i>
110—120	<i>Crocidura grandiceps</i>	—
120—130	—	—
130—140	<i>Crocidura (f.) manni</i>	<i>Crocidura (f.) manni</i>
140—150	<i>Crocidura odorata</i>	<i>Crocidura odorata</i>



## ACKNOWLEDGEMENTS

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## KEYS AND FIGURES

We have records of three genera of shrews from Nigeria, *Sylvisorex*, *Suncus* and *Crocidura*. Two other genera, *Myosorex* and *Paracrocidura*, are likely to occur in the mountainous regions of eastern Nigeria. A key to the genera of shrews was provided by Heim de Balsac & Meester (1977) and is not repeated here. We provide a key to all species occurring in Nigeria, based only on external characters which can be used for a tentative identification. A more thorough identification should follow using the species accounts and, in the case of *Crocidura*, the key to skulls of that particular genus. Figures of skulls are given for each species: the whole cranium in dorsal, ventral and lateral views, and a mandibular ramus in lateral view. The second and third upper molars as well as the first and second upper incisors are enlarged to show their important characters. All figures were taken from specimens collected in Nigeria, even if more complete skulls were available from other countries. No attempts were made to idealize the figures.

Scales for Figures 1—24 are 10 millimetres for skulls and mandibels, and 5 millimetres for the enlarged teeth.

### Key to the species of Soricidae known from Nigeria, based on external characters

- |  |                                       |
|--|---------------------------------------|
| 1. Small, head and body less than 70 mm .....  | 2                                     |
| Head and body more than 70 mm .....  | 12                                    |
| 2 Tail distinctly longer than head and body .....  | 3                                     |
| Tail shorter than head and body .....  | 4                                     |
| 3. Hindfoot long, 14—15 mm .....   | <i>Sylvisorex megalura</i> (p. 40)    |
| Hindfoot shorter, 12 mm .....  | <i>Crocidura dolichura</i> (p. 64)    |
| 4. Hindfoot 7—8 mm .....   | <i>Suncus etruscus</i> (p. 40)        |
| Hindfoot 9—12 mm .....   | 5                                     |
| 5. Larger, hindfoot 12 mm, tail 54 mm, dorsal surface greyish-brown to pale chocolate-brown .....  | <i>Crocidura crossei</i> (p. 62)      |
| Smaller, hindfoot 9—11 mm, tail 40—48 mm .....   | 6                                     |
| 6. Ventral pelage pure white; Sudan savanna zone .....   | <i>Crocidura lusitania</i> (p. 72)    |
| Ventral pelage not pure white .....  | 7                                     |
| 7. Dorsal surface and limbs rich chocolate-brown; ventral pelage slightly paler; tail with few bristles only; mostly rainforest zone .....   | <i>Crocidura bottegi</i> (p. 66)      |
| Dorsal surface, tail and feet not rich chocolate-brown .....   | 8                                     |
| 8. Ears, tail and feet pale; lower half of the tibia free of long body hairs; tail densely covered with long bristles; ears very large ..... | <i>Crocidura yankariensis</i> (p. 67) |
| Not this combination of characters .....   | 9                                     |
| 9. Tail 30 mm .....  | <i>Suncus varilla</i> (p. 41)         |
| Tail longer than 30 mm .....   | 10                                    |
| 10. Occurs in forests or forest patches in savanna zones .....   | <i>Crocidura douceti</i> (p. 68)      |
| Occurs in grassland or swamp habitats in savanna zones .....   | 11                                    |

11. Distinctly bicoloured; dorsal surface brownish, ventral surface silvery-grey; Guinea savanna zone ..... *Crocidura fuscomurina* (p. 69)  
 Less distinctly bicoloured; dorsal surface greyish-brown to blackish-grey; Guinea and Sudan savanna zones ..... *Crocidura planiceps* (p. 70)
12. Very large shrews; hindfoot more than 20 mm ..... 13  
 Smaller; hindfoot less than 20 mm ..... 14
13. Large, entirely black shrew ..... *Crocidura odorata* (p. 48)  
 Large, pale or greyish, never black ..... *Crocidura (flavescens) manni* (p. 42)
14. Dorsal and ventral surfaces brown to blackish-brown ..... 15  
 Dorsal surface very different in colour from ventral surface ..... 20
15. Larger, hindfoot 18—19 mm ..... 16  
 Smaller, hindfoot 13—17 mm ..... 17
16. Head and body 95—111 mm, tail 50—69 mm; occurs in swamps within dry savanna zones ..... *Crocidura longipes* n. sp. (p. 53)  
 Head and body 98—119 mm, tail 55—74 mm, rain forests of south-western Nigeria ..... *Crocidura grandiceps* (p. 55)
17. Hindfoot short, 13—14 mm ..... 18  
 Hindfoot longer, 16—17 mm ..... 19
18. Hindfoot 13 mm; savanna zones ..... *Crocidura gracilipes* (p. 63)  
 Hindfoot 14 mm; rain forest zone ..... *Crocidura buettikoferi* (p. 49)
19. Hindfoot  $\pm$  16 mm, tail 57 mm; dark brown ..... *Crocidura poensis* (p. 50)  
 Hindfoot  $\pm$  17 mm, tail 64 mm; less dark ..... *Crocidura nigeriae* (p. 51)
20. Dorsal surface greyish-brown to chocolate-brown ..... 21  
 Dorsal surface pale reddish-brown or cinnamon-brown ..... 22
21. Hindfoot 13 mm; dorsal surface dark grey or greyish-brown; ventral surface greyish-white ..... *Crocidura foxi* (p. 60)  
 Hindfoot 14 mm; dorsal and ventral surfaces uniformly grey; tail and feet whitish; tail thick and well haired ..... *Crocidura lamottei* (p. 59)
22. Tail 32 mm, thick and broad; hindfoot 13 mm ..... *Crocidura butleri* (p. 58)  
 Tail about 57—63 mm, hindfoot 16 mm ..... 23
23. Dorsal surface reddish-brown, somewhat dappled; tail bicoloured, thick with long bristles ..... *Crocidura viaria* (p. 56)  
 Dorsal surface light-brown or cinnamon-brown; tail more uniform, thin with long bristles reaching the tip of the tail ..... *Crocidura fulvastra* (p. 57)

### Key to skulls of *Crocidura* known from Nigeria

Diagnosis of *Crocidura*: Three pairs of upper unicuspid teeth; tip of the first upper incisor conical; upper molariform teeth with distal margins concave; first lower premolar unicuspid.

1. CI longer than 30.0 mm, UTR longer than 12.0 mm ..... (*flavescens*) *manni* (Fig. 4)  
     CI and UTR shorter ..... *odorata* (Fig. 5)  
     ..... 2
2. CI 21.4–27.5 mm, UTR 10.0–11.7 mm ..... 3  
     CI 15.2–19.9 mm, UTR 6.5–8.6 mm ..... 12



3. Anterior half of skull markedly narrower than posterior half; interorbital constriction not extremely narrow; braincase in dorsal view  $\pm$  as long as broad; dorsal profile of skull slightly curved, sometimes convex; third upper molar large with well developed ridge; mainly in rainforest zone (except *longipes*, which lives in savanna zones) ..... 4
- Anterior half of skull not markedly narrower than posterior half; interorbital region narrow; braincase longer than broad,  $\pm$  oval; dorsal profile of skull straight; braincase flat; third upper molar small and thin, with reduced ridge; in savanna zones ..... 8
4. CI shorter than 23.0 mm, UTR 10.0-10.1 mm; rostrum narrow; braincase domed; rainforest zone ..... *buettikoferi* (Fig. 6)
- CI longer than 23.0 mm; braincase not markedly domed ..... 5
5. MB shorter than 7.6 mm ..... 6
- MB longer than 7.6 mm ..... 7
6. CI 23.0-24.8 mm, MB 6.0-7.5 mm, UTR 9.7-11.1 mm; mainly in rainforest zone ..... *poensis* (Fig. 7)
- CI 24.2-25.4 mm, MB 7.1-7.5 mm, UTR 10.7-10.9 mm; in dry savanna zones ..... *longipes* n. sp. (Fig. 9)
7. CI 24.4-25.9 mm, MB  $\pm$  7.8 mm, UTR 10.6-11.5 mm; in rainforest zone . *nigeriae* (Fig. 8)
- CI 25.4-27.4 mm, MB 7.7-8.5 mm, UTR 10.6-11.7 mm; in rainforest zone ..... *grandiceps* (Fig. 10)
8. Interorbital constriction narrow in relation to braincase and maxillary region; skulls look like an hour-glass (Figs. 13-15); width of upper molars greater than length; third upper molar much reduced ..... 9
- Shape of skull not like an hour-glass; upper molars roughly square; third upper molar less reduced (Figs. 11,12) ..... 11
9. Large, MB 8.1-8.8 mm, UTR 11.1-11.5 mm; mandible heavy; ascending ramus high; derived savanna zone ..... *lamottei* (Fig. 14)
- Smaller, mandible more delicate ..... 10
10. Upper molars very broad and short; third upper molar much reduced; second upper incisor very large; Sudan savanna zone ..... *butleri* (Fig. 13)
- Upper molars less broad and short; third upper molar less reduced; second upper incisor smaller; savanna patches in rainforest zone, and on Jos plateau ... *foxi* (Fig. 15)
11. Shape of braincase oval; dorsal profile straight; rostrum long; first upper incisor long and curving downwards, dagger-like; very similar to the following species, but: outer edge of maxilla angular; skull narrower; in Sudan savanna zone ..... *fulvastra* (Fig. 12)
- Very similar to the preceding species, but: outer edge of maxilla more even; braincase and maxillary region broader; Sudan savanna zone ..... *viaria* (Fig. 11)
12. CI 18.5-19.9 mm, UTR 7.7-8.6 mm ..... 13
- CI and UTR shorter ..... 16
13. Mid-dorsal line of skull straight in lateral view ..... 14
- Mid-dorsal line of skull curved; braincase domed ..... 15
14. Dorsal profile angular; rostrum slender; maxillary region narrow; rainforest and Guinea savanna zones ..... *crossei* (Fig. 16)
- Dorsal profile straight, not markedly angular; maxillary region broad; anterior parts of braincase with angular crest; fourth upper premolar very heavy; Sudan savanna zone ..... *yankariensis* (Fig. 20)

15. Braincase highly domed; rostrum short; dentition very weak; rainforest zone ..... *dolichura* (Fig. 18)  
 Braincase slightly domed; rostrum not as short; dentition less weak; third upper molar large; savanna zones ..... *gracilipes* (Fig. 17)
16. Braincase domed, round in dorsal view; anterior part of skull short; rainforest zone and forest patches in savanna zones ..... *bottegi* (Fig. 19)  
 Dorsal profile straight or angular; braincase never domed ..... 17
17. CI  $\pm$  18.0 mm, UTR  $\pm$  7.4 mm ..... *fuscomurina* (Fig. 22)  
 CI and UTR shorter ..... 18
18. Braincase very flat; dorsal profile very straight ..... 19  
 Braincase normally high; dorsal profile angular; maxillary region broad; mainly in Guinea savanna ..... *douceti* (Fig. 21)
19. Skull extremely flat; interorbital constriction narrow; third upper molar very small; Sudan and Sahel savanna zones ..... *lusitania* (Fig. 24)  
 Skull less extremely flat; interorbital constriction less narrow; anterior part of skull more slender; third upper molar of normal size; Guinea and Sudan savanna zones ..... *planiceps* (Fig. 23)

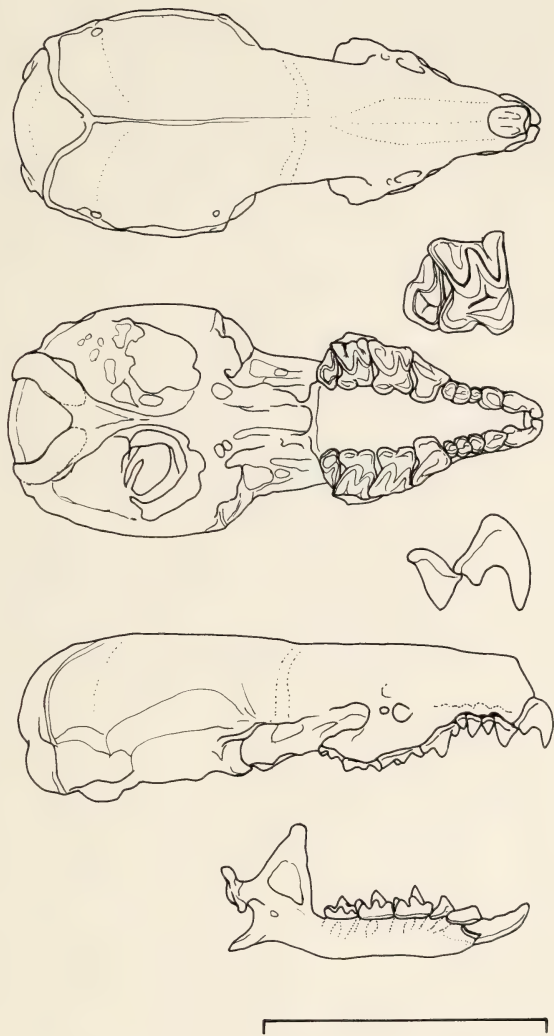


Fig. 1: Skull of *Sylvisorex megalura* (USNM 402311) from Afon.





Fig. 2: Skull fragment of *Suncus etruscus* (AD 61) from Futuk.

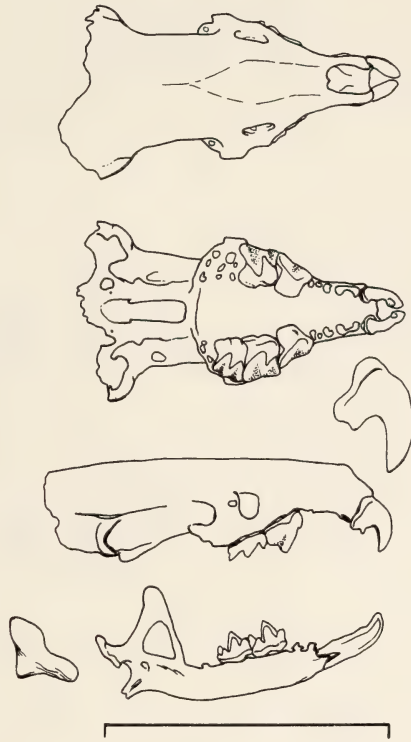


Fig. 3: Skull fragment of *Suncus varilla* (RNHL 31005) from Toro.

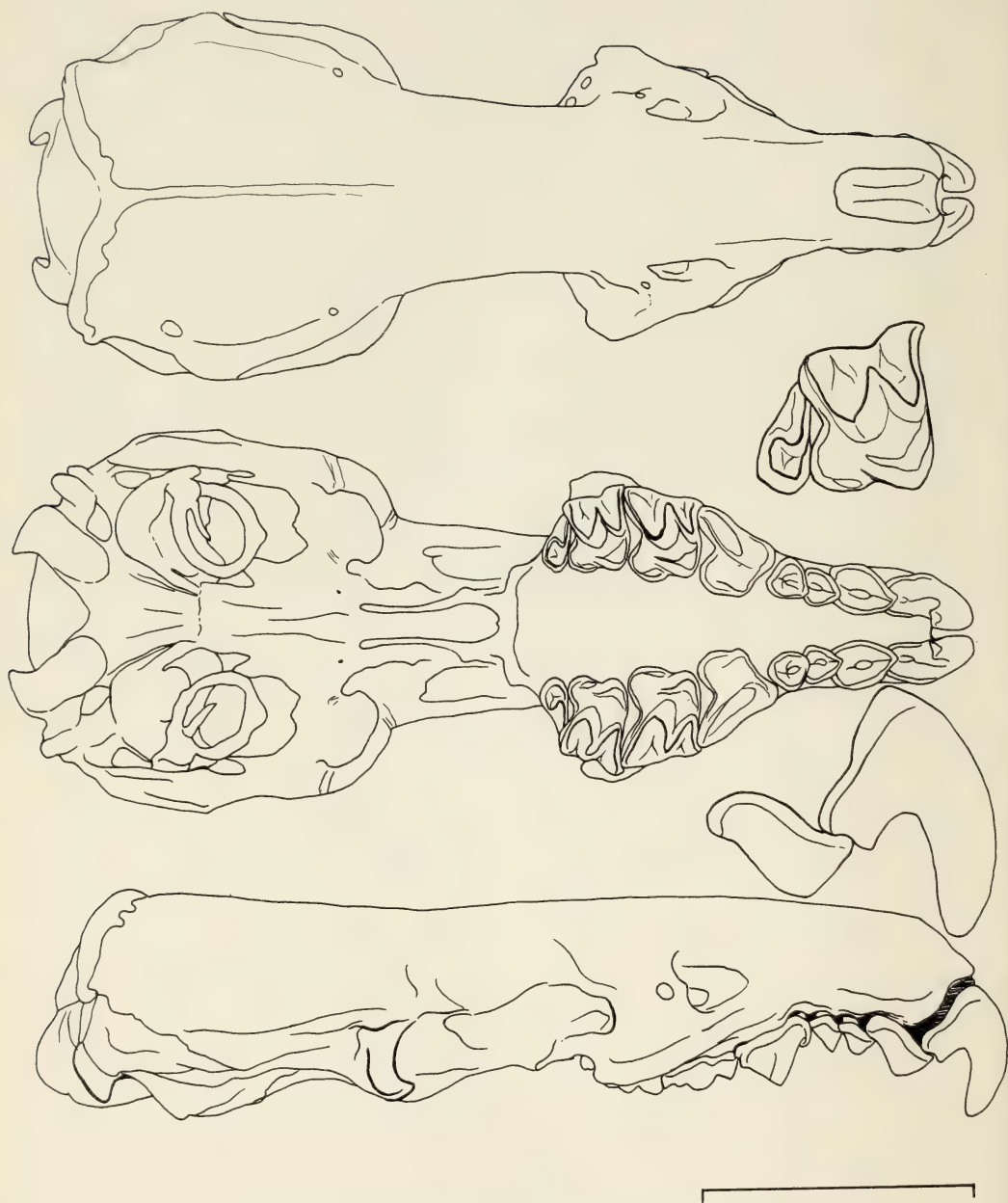


Fig. 4: Skull of *Crocidura (flavescens) manni* (USNM 379476) from Ibadan.



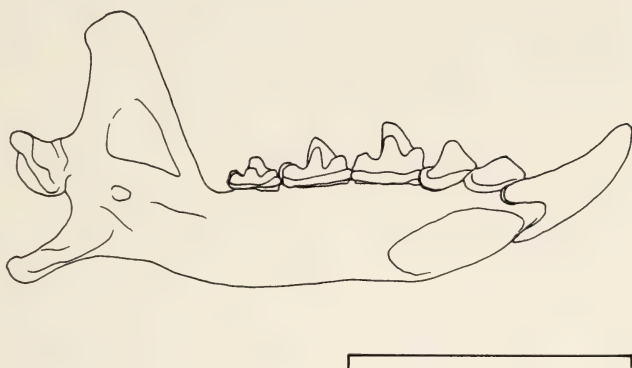


Fig. 4 a: Mandible of *Crocidura (flavescens) manni* (USNM 379476).

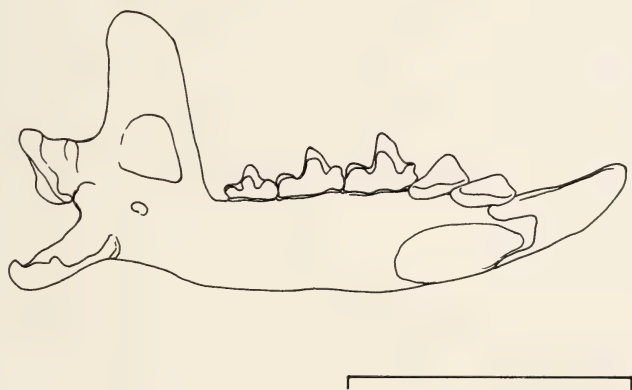


Fig. 5 a: Mandible of *Crocidura odorata* (USNM 402304).

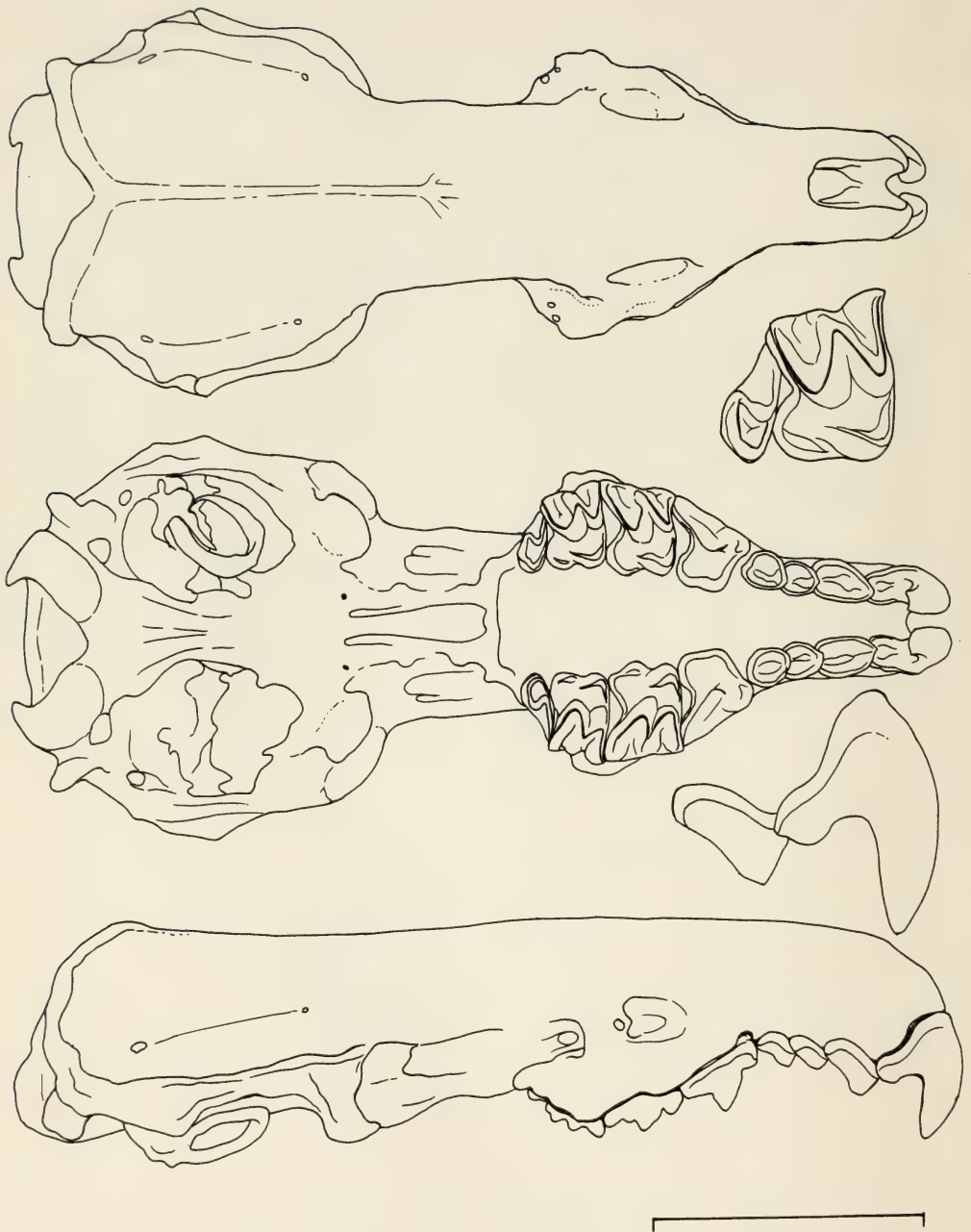


Fig. 5: Skull of *Crocidura odorata* (USNM 402304) from Dada.

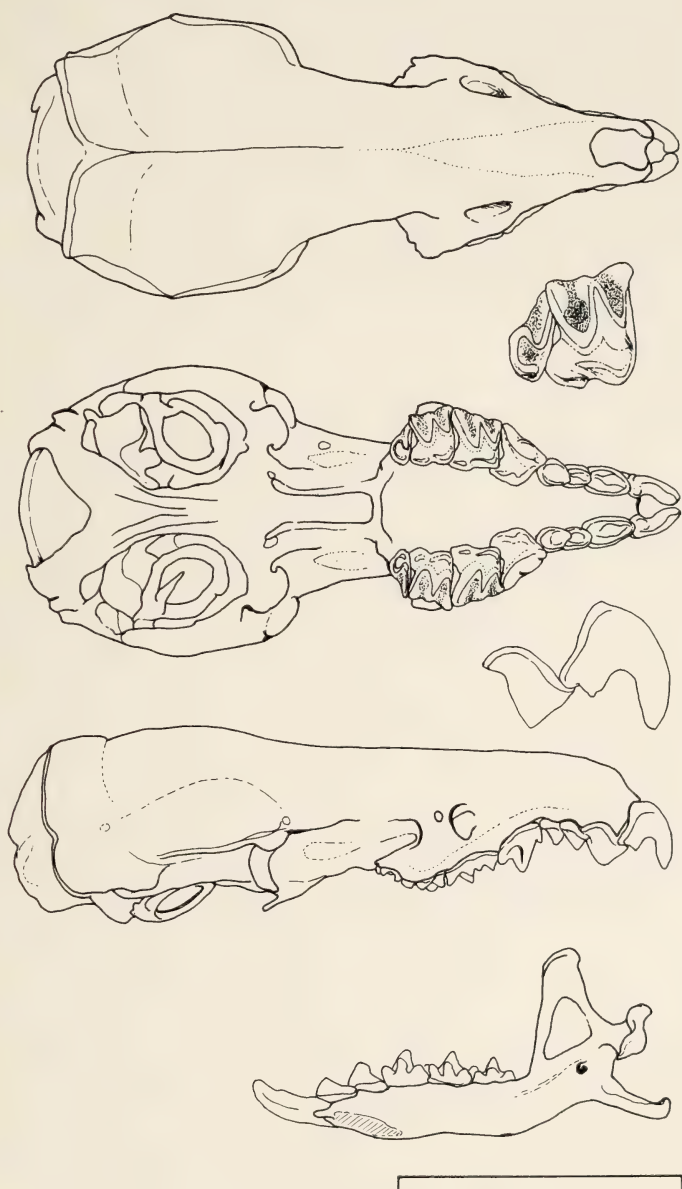


Fig. 6: Skull of *Crocidura buettikoferi* (BMNH 52.99) from Umuahia.



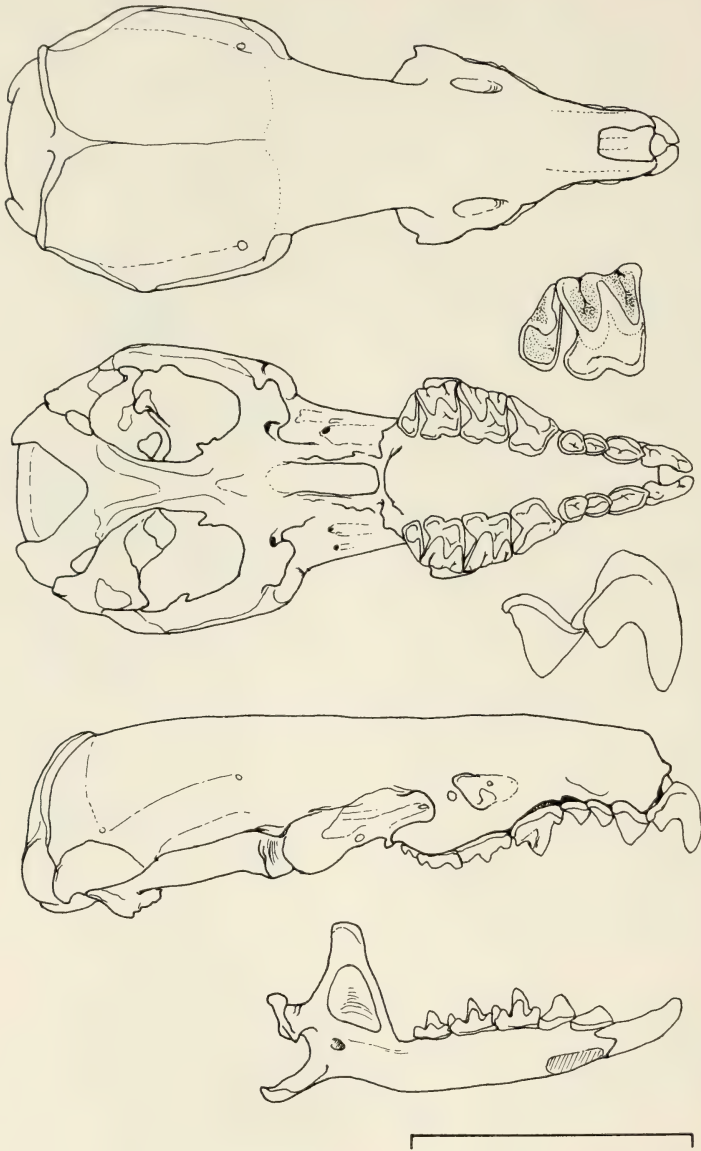


Fig. 7: Skull of *Crocidura poensis* (BMNH 50.831) from Owerri.

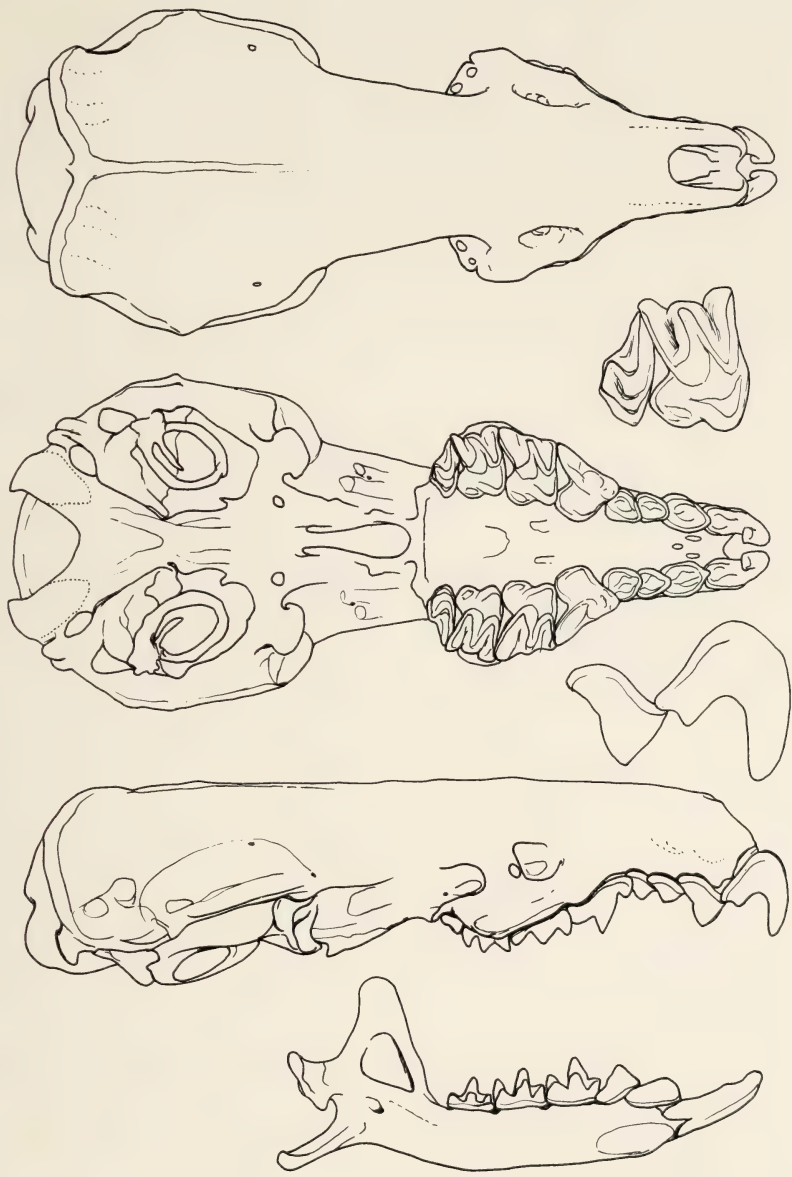


Fig. 8: Skull of *Crocidura nigeriae* (ZFMK 82.115) from Oyakama, near Port Harcourt.

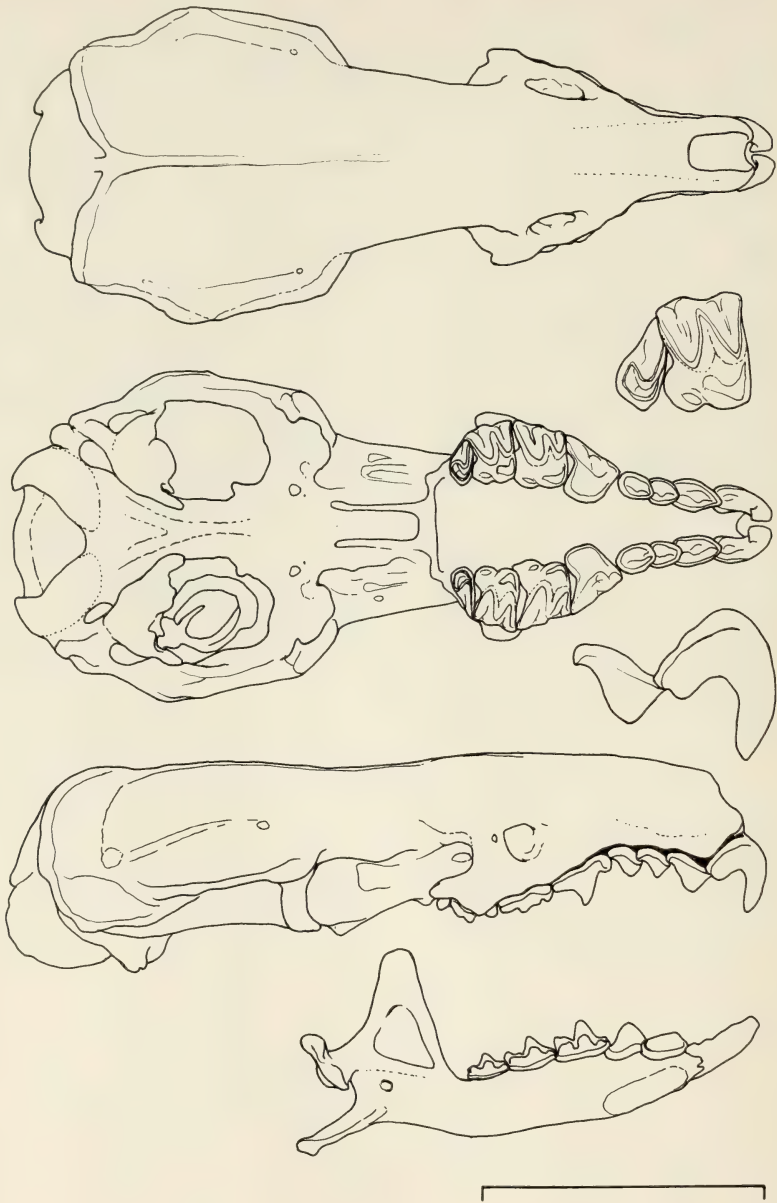


Fig. 9: Skull of *Crocidura longipes* new species (USNM 462309, the holotype) from Dada.



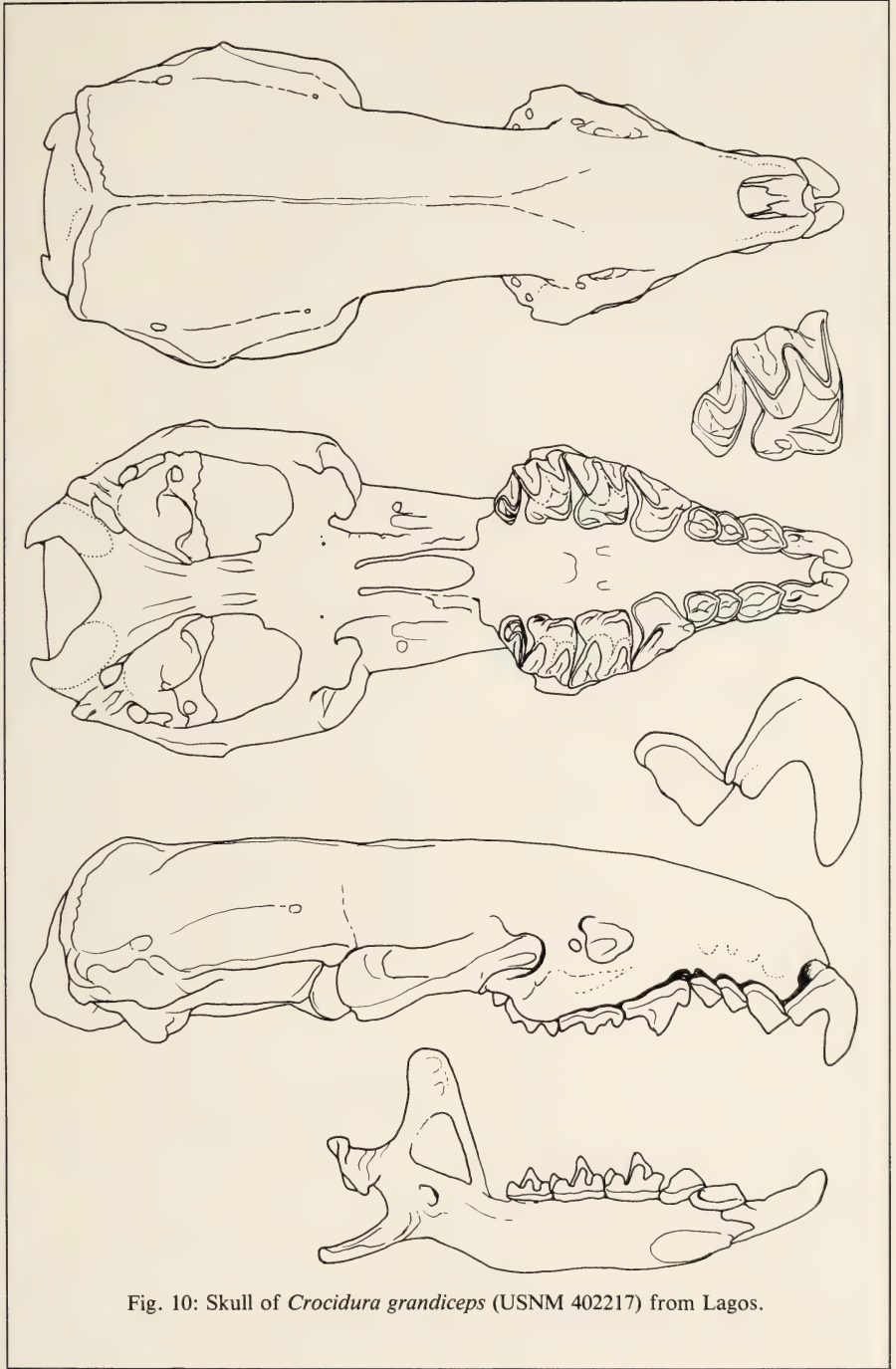


Fig. 10: Skull of *Crocidura grandiceps* (USNM 402217) from Lagos.

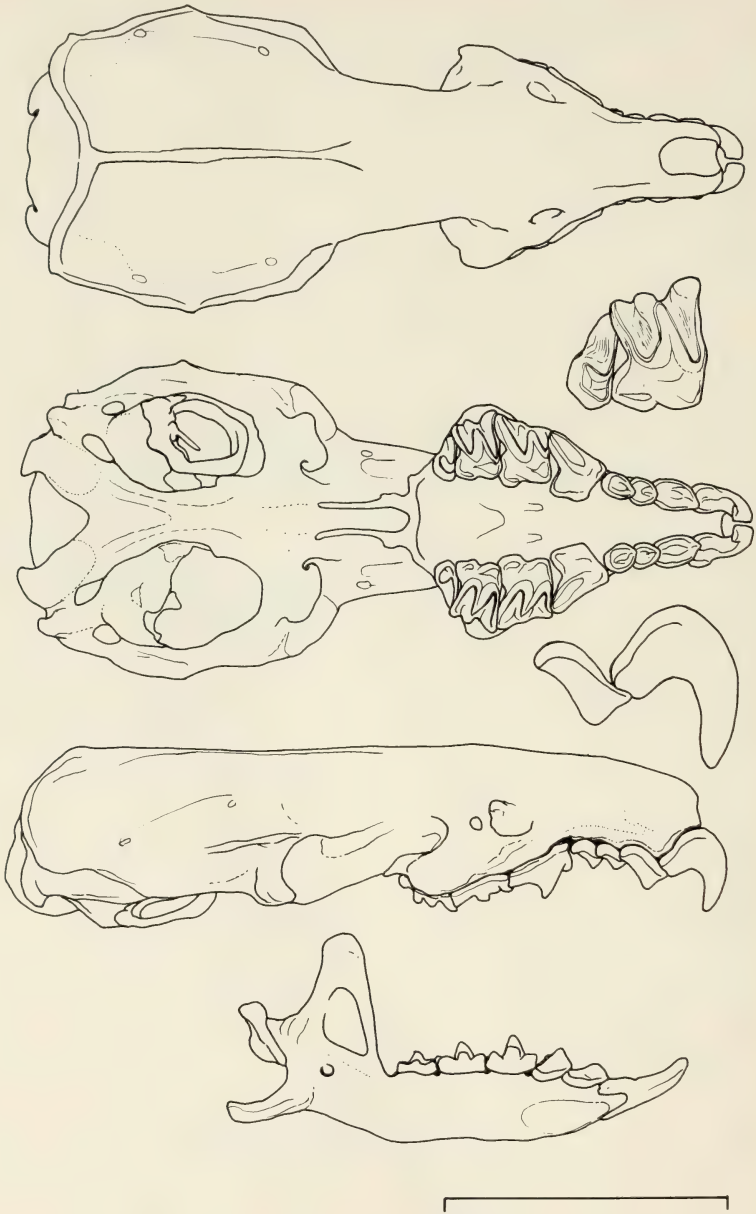


Fig. 11: Skull of *Crocidura varia* (USNM 402252) from Tangaza.

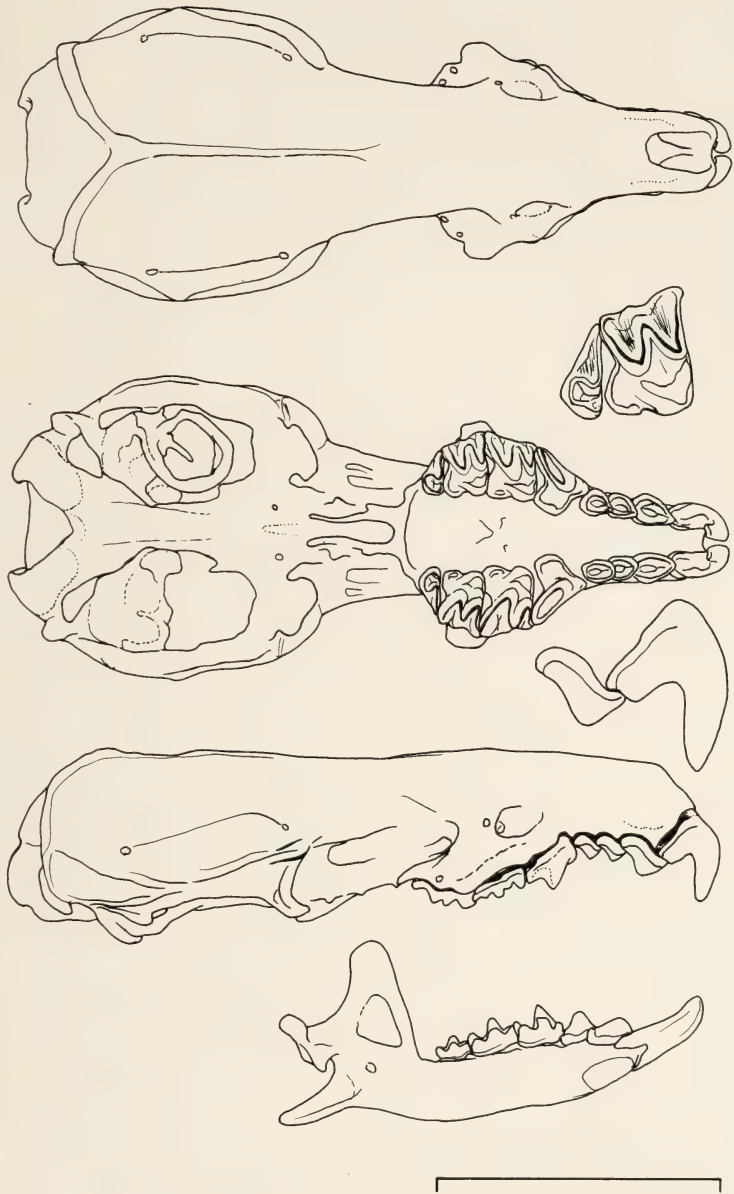


Fig. 12: Skull of *Crocidura fulvastra* (USNM 378754) from Dikwa.

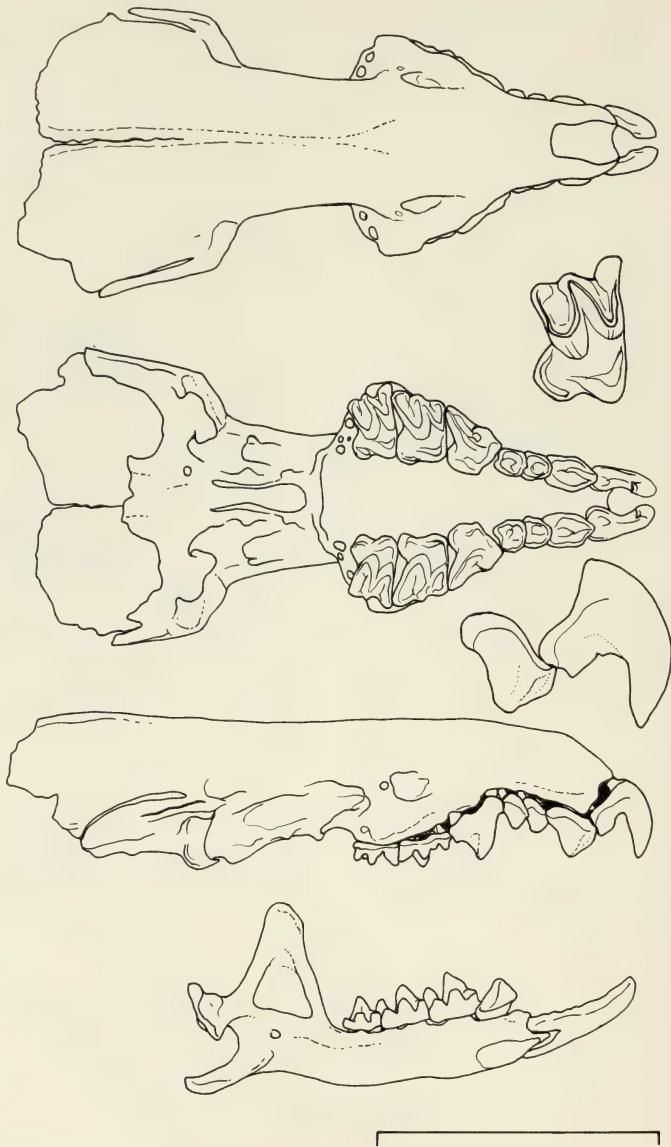


Fig. 13: Skull fragment of *Crocidura butleri* (AD 26) from Futuk.



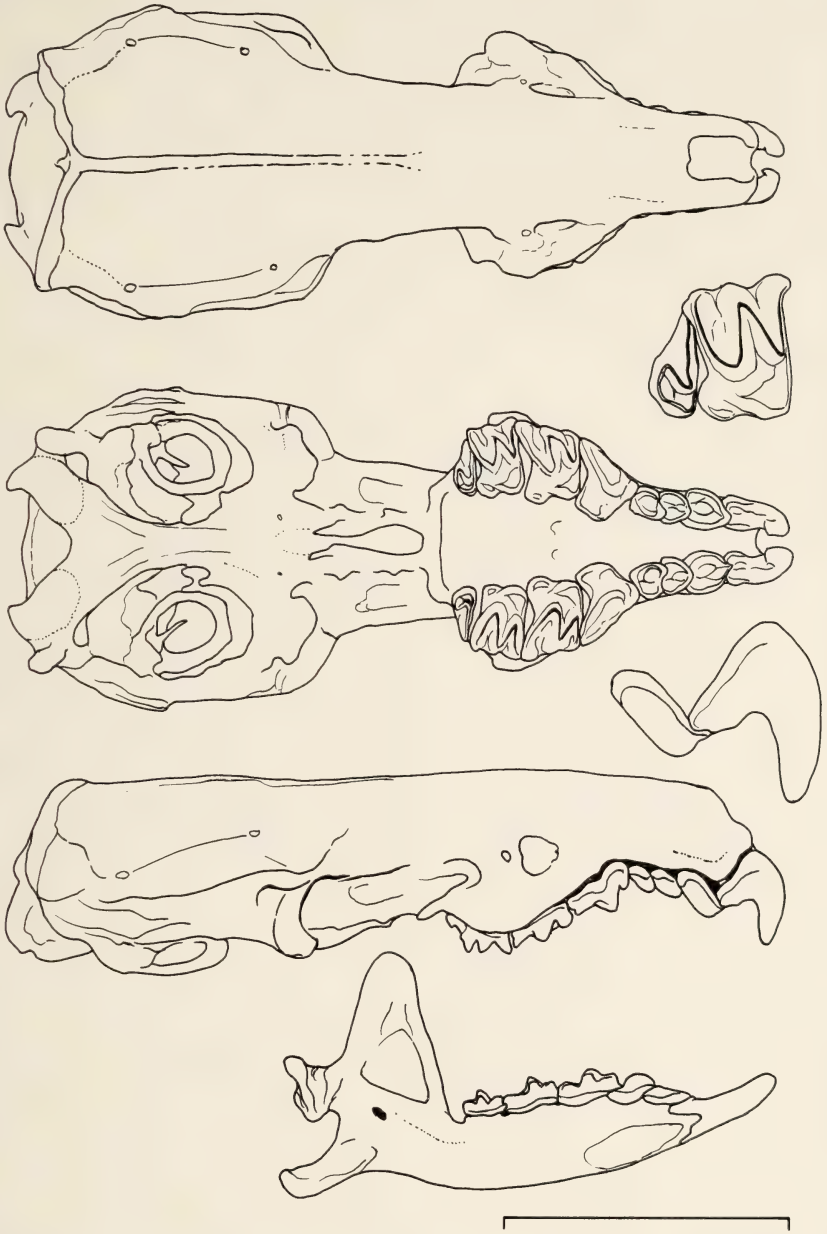


Fig. 14: Skull of *Crocidura lamottei* (USNM 402233) from Upper Ogun ranch.

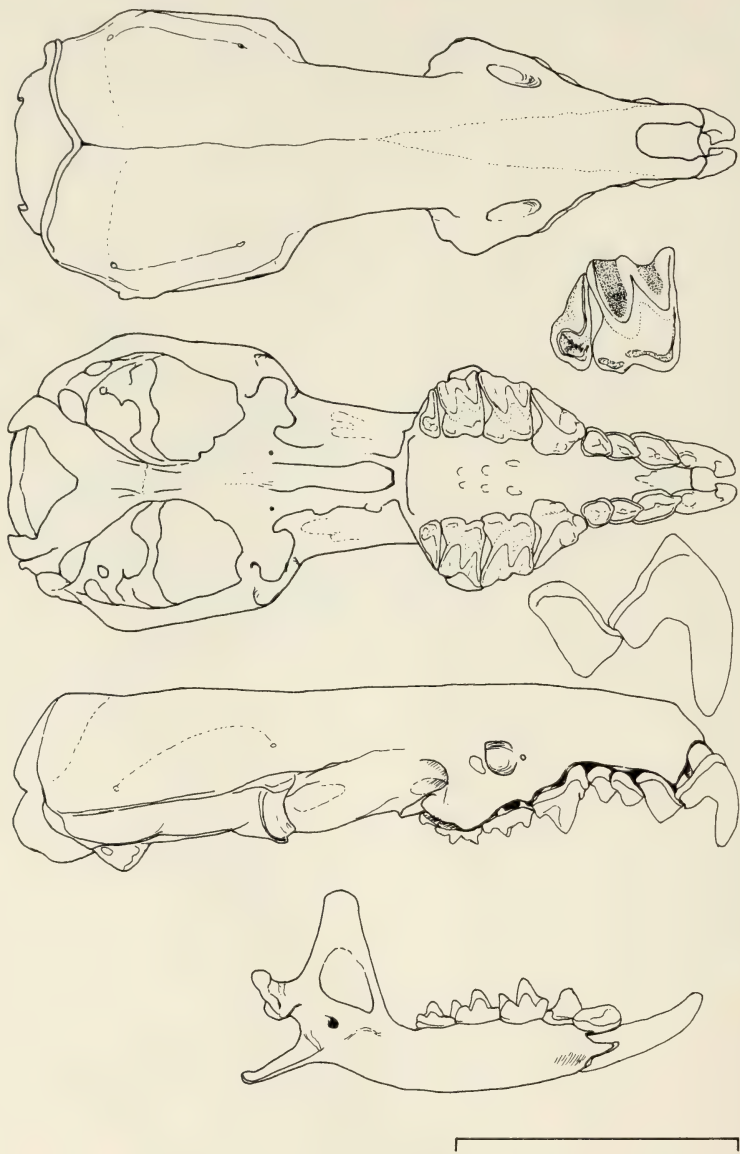


Fig. 15: Skull of *Crocidura foxi* (BMNH 50.827) from Owerri.

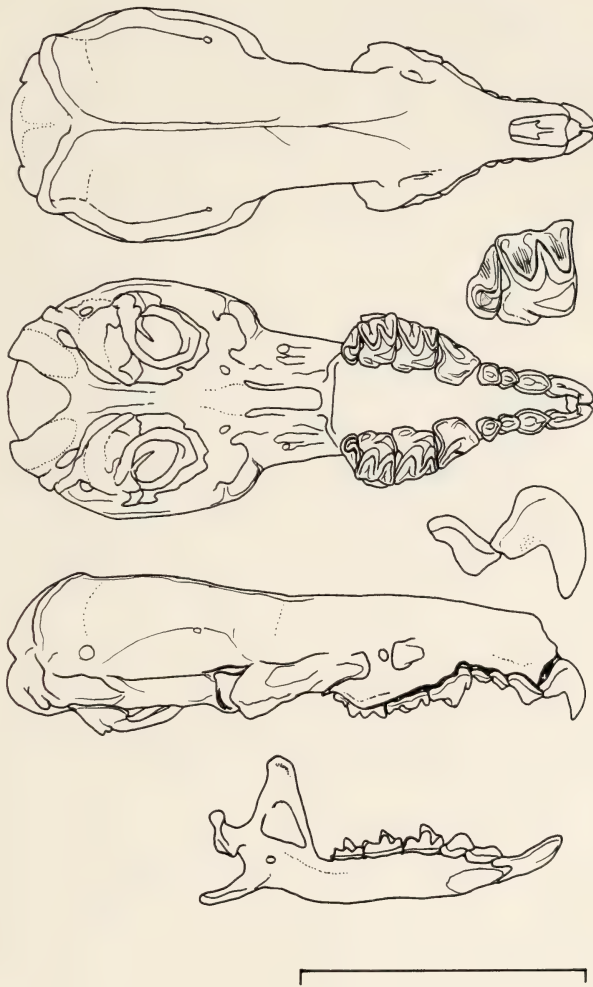


Fig. 16: Skull of *Crocidura crossei* (DH 889) from Gambari F. R.

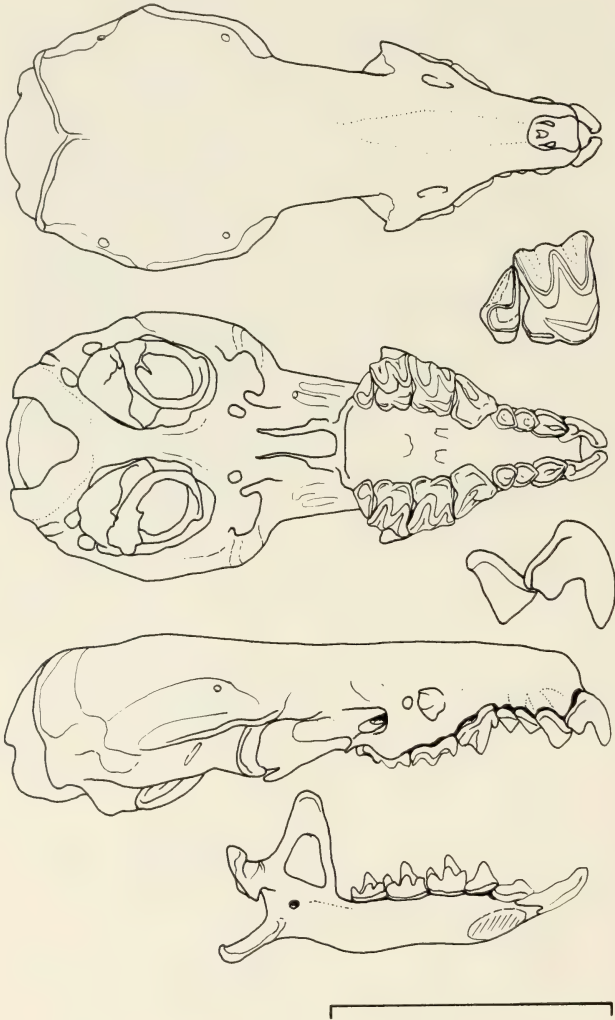


Fig. 17: Skull of *Crocidura cf. gracilipes* (AM 1644) from Okpuje.



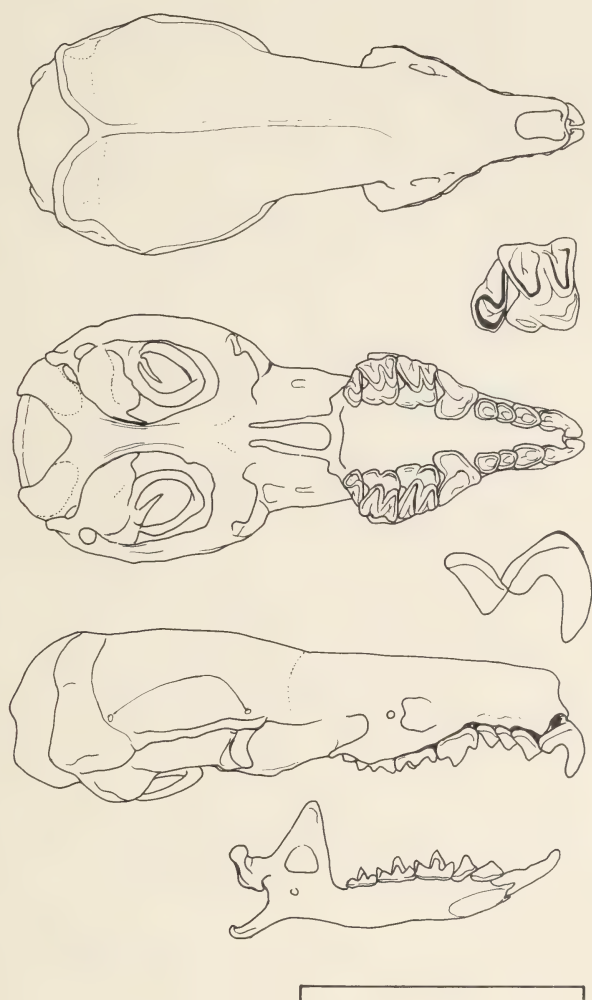


Fig. 18: Skull of *Crocidura dolichura* (USNM 377058) from 15 miles north Calabar.

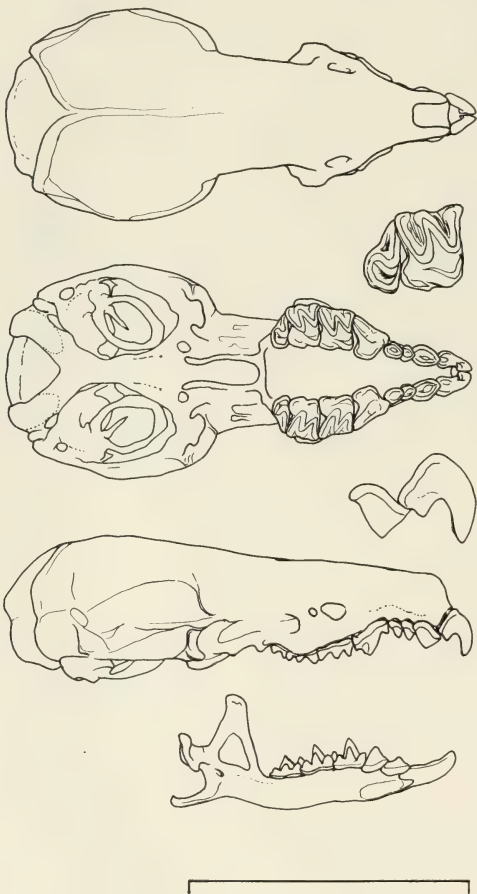


Fig. 19: Skull of *Crocidura bottegii* (DH 1380) from Shasha.

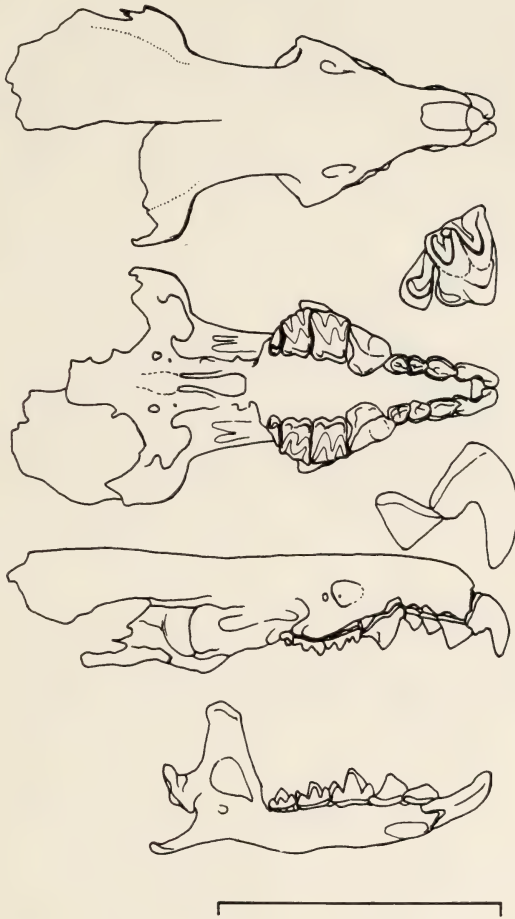


Fig. 20: Skull fragment of *Crocidura yankariensis* (Type series from Yankari G. R.). Skull and mandible are from different animals.

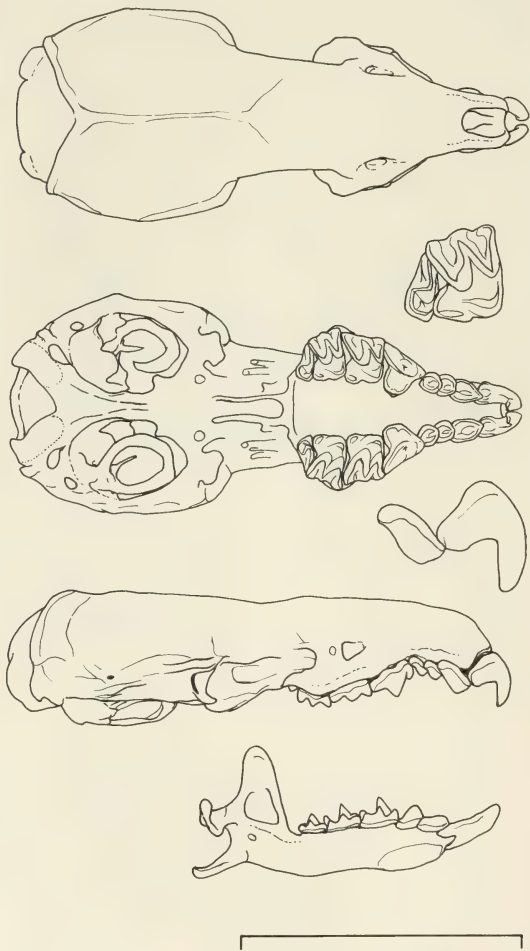


Fig. 21: Skull of *Crocidura doucetii* (DH 1168) from Abuja.



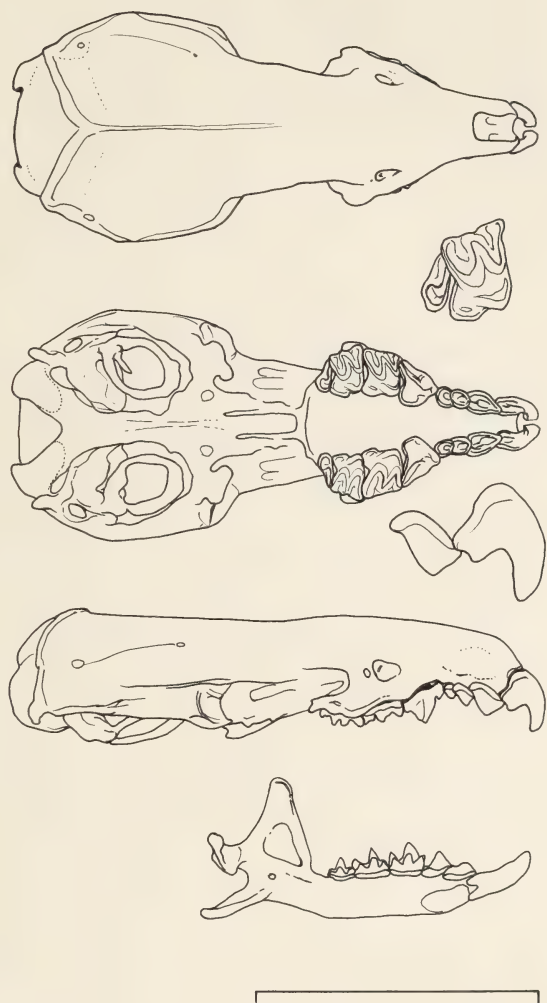


Fig. 22: Skull of *Crocidura fuscomurina* (DH 1327) from New Bussa.

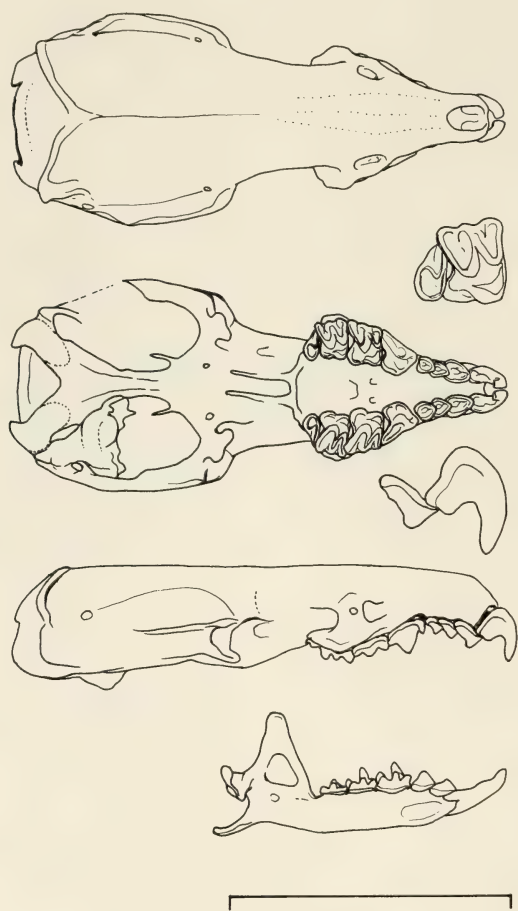


Fig. 23: Skull of *Crocidura planiceps* (USNM 402256) from Kware, 14 miles north Sokoto.

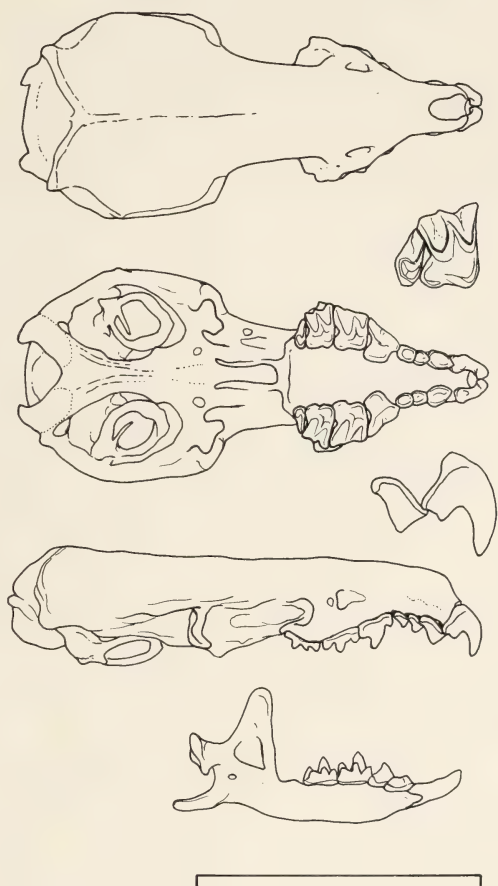


Fig. 24: Skull of *Crocidura lusitania* (USNM 402254) from Kware, 14 miles north Sokoto.

## DESCRIPTIVE ACCOUNTS

### Genus *Sylvisorex*

#### *Sylvisorex megalura* (Jentink)

Fig. 1

*Pachyura megalura* Jentink, 1888: 48; Schieffelinville, Liberia.

**D i a g n o s i s:** Small shrews. Dorsal pelage chocolate-brown; ventral pelage greyish-white. Tail very long and slender, without any long hairs; about 123 % of HB. Hindfoot long, adapted for climbing. Skull (Fig. 1) short and narrow with a highly domed braincase. Dentition weak, four pairs of unicuspid teeth in the upper jaw. First lower incisor with two tubercles.

**M e a s u r e m e n t s:** A single adult female from Afon: HB 53, T 71, HF 15, E 9, WT 4, CI 17.7, IW 4.1, MB 5.6, GW 7.7, HCC 4.8, UTR 7.5.

**D i s t r i b u t i o n:** One adult female and two juveniles from Afon are the first records of the species from Nigeria. The overall distribution of the climbing shrew ranges from Guinea to Mozambique.

**N a t u r a l h i s t o r y:** No information is available on these shrews except that the specimens from Afon were caught in Guinea savanna. The species climbs very well (Vogel 1974) and may therefore live in shrubby habitats rather than in grassland savannas.

Information on ecology and reproduction is given by Dieterlen & Heim de Balsac (1979). In the Kivu area, *Sylvisorex megalura* is abundant in swamps and in cultivated areas, but not common in the rainforest. There are 1—2 young in a litter. The juveniles stay with their mother until they are fully grown up.

**T a x o n o m y:** The single adult specimen does not differ from typical *S. megalura* and may therefore represent the nominal subspecies. Of course, more material from Nigeria is needed before final conclusions can be drawn.

**S p e c i m e n s e x a m i n e d** (3):

Afon, USNM 402311-3.

### Genus *Suncus*

#### *Suncus etruscus* (Savi)

Fig. 2, Map 8

*Sorex etruscus* Savi, 1822: 60, pl. 1; Pisa, Italy. — *Suncus etruscus* (sic) Morrison-Scott, 1946: 145; Sherifuri, Nigeria.



**D i a g n o s i s :** One of the smallest shrews occurring in Africa. Dorsal pelage brown; ventral pelage paler. Tail long, thickset and broad at base with numerous long bristles; about 86 % of HB. Ears large and „naked”. Skull (Fig. 2) very flat; rostrum shorter and more flattened than in the similar *Suncus infinitesimus*. Four pairs of unicuspid teeth in the upper jaw.

**M e a s u r e m e n t s :** A single male from Sherifuri: HB 38, T 33, HF 7.2, E 5, WT 2, IW 3.3, MB 3.8, UTR 5.3.

**D i s t r i b u t i o n :** Recorded only from two localities in the Sudan savanna zone of Bauchi State: Sherifuri (Morrison-Scott 1946) and Futuk (Demeter 1981). These tiny shrews are widespread in Africa north of the Sahara, Europe and Asia, but the only records south of the Sahara are from Guinea, Nigeria and Ethiopia (Heim de Balsac 1958, Heim de Balsac & Meester 1977).

**N a t u r a l h i s t o r y :** The specimen from Sherifuri was found on a „stream bank”, and remains of these shrews have been found in owl pellets from Futuk.

**T a x o n o m y :** *Suncus etruscus* is very similar to another related species, *Suncus infinitesimus*. This is the reason why the fragmentary specimen from Futuk was at first misidentified (Hutterer, in Demeter 1981); however, close examination of the specimen from Sherifuri shows that it belongs to *Suncus etruscus* and not to *S. infinitesimus* as suggested by Petter & Chippaux (1962) and Heim de Balsac & Meester (1977). Intact skulls of *Suncus infinitesimus* are larger (CI 14.6 in the holotype against 13.8 in *Suncus etruscus*) and have a higher rostrum and braincase. The skull of *Suncus etruscus* is extremely flat.

**S p e c i m e n s e x a m i n e d (2):**

Futuk, AD 61; Sherifuri, BMNH 46.517.

### *Suncus varilla* (Thomas)

Fig. 3

*Crocidura (Pachyura) varilla* Thomas, 1895: 54; East London, Cape of Good Hope.

**D i a g n o s i s :** Dorsal pelage greyish-brown to cinnamon-brown; hairs brownish with grey tips. Ventral pelage and flanks grey to silvery-grey; hairs with white tips. Tail thin, brown with long grey hairs; about 66 % of HB. Feet with small white hairs (taken from Allen & Loveridge 1933). Skull (Fig. 3) distinctly larger than in the preceding species (CI 15.1—17.0, Meester & Lambrechts 1971), flat, but braincase slightly domed.

**M e a s u r e m e n t s :** No external measurements available; an incomplete skull from Toro: IW 3.6, MB 4.9, UTR 7.1.

**D i s t r i b u t i o n :** A skull fragment taken from owl pellets is a surprising new record from Nigeria. The species was known before only south of Upemba, Zaire (Heim de Balsac & Meester 1977).

**Natural history:** No information except that the specimen was found in owl pellets.

**Taxonomy:** The Toro skull is damaged; it consists of the anterior portion of a skull and a mandibular ramus. A comparison with complete skulls revealed its identity. The few obtainable measurements are in full agreement with those given by Meester & Lambrechts (1971) for the range of *Suncus varilla*.

**Specimen examined** (1): Toro, RNHL 31005.

### **Genus *Crocidura***

Twenty-one species of *Crocidura* are listed below. The genus is exceedingly complex, so that nobody really knows how many species live in Africa. Honacki, Kinman & Koepl (1982) list 99 species from Africa, but the taxonomic problems in this genus are far from being solved. We have found it useful to divide the following species accounts into several species groups, which may, but do not necessarily, reflect phylogenetic relationships; some are simply clusters of similar forms and should not be regarded as taxonomic units. The main purpose of the species groups is to simplify identification of the species.

### **African Giant Shrews**

#### ***Crocidura (flavescens) manni* Peters**

Figs. 4, 25, 26, 27, Map 2

*Crocidura (Crocid.) manni* Peters, 1878: 19; Lagos, Nigeria. Lectotype designated here: SMNS 1646a.

**Diagnosis:** One of the two largest shrews in the country. Dorsal and ventral pelage dark smoky-grey to dark-brown or ginger-brown in southern Nigeria, pale grey in northern Nigeria (see Table 3). Tail relatively long with scattered white hairs and numerous bristles; about 70 % of HB. Tail thick at base, tapering to its tip. Very strong musky secretions give a distinctive and rather unpleasant smell. Skull (Fig. 4) very large and heavy, flat in profile. Rostrum, maxilla and braincase broad, but interorbital constriction long and narrow. Dentition very heavy, particularly the incisors.

**Measurements:** Five adults from Ibadan: HB 110–140, T 85–100, HF 21–23, E 12–14, WT 37–65, CI 32.0–34.3, IW 5.9–6.5, MB 9.9–11.0, GW 13.2–14.4, HCC 7.3–7.9, UTR 14.0–15.4. See also Table 4.

**Distribution:** *Crocidura (flavescens) manni* is the most abundant species in Nigeria (Map 2). It occurs in all parts of the country and in all kinds of natural habitats

Table 3: Geographic colour variation of the dorsal pelage in *Crocidura (flavescens) manni* (n = 70 skins from Nigeria, adults and juveniles, USNM).

Origin of series	dorsal pelage from dark (1) to pale (5)*				
	(1)	(2)	(3)	(4)	(5)
Sudan savanna			1	4	13
Guinea savanna		2	4	5	5
Derived savanna		4	8	3	
Rainforest zone	1	4	9	7	
	1	10	22	19	18 : 70

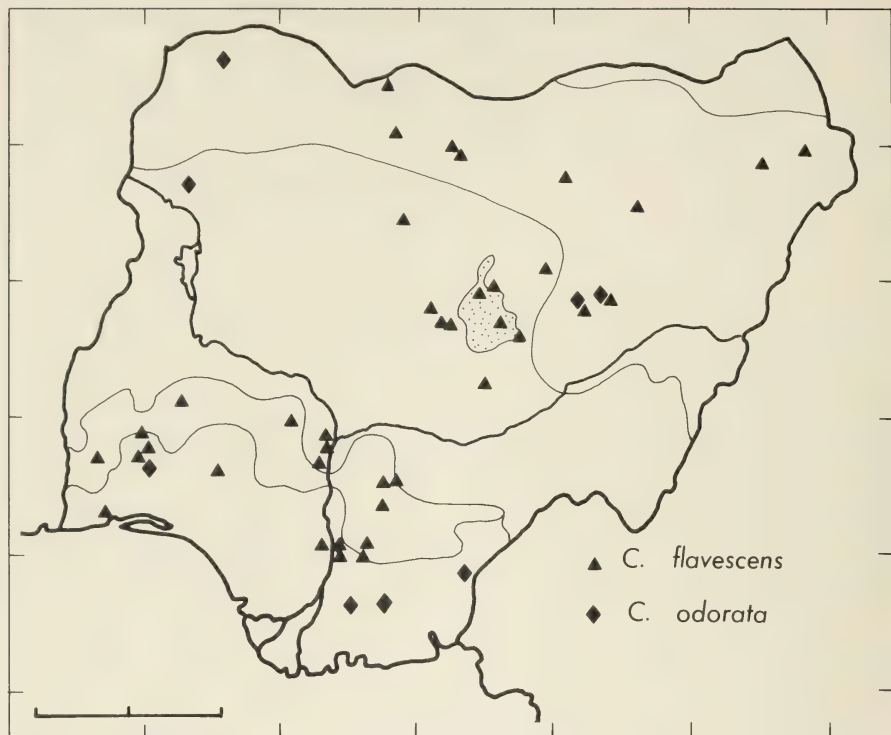
\* Colours from Ridgway (1912): (1) Hair Brown (2) Drab (3) Wood Brown (4) Avellaneous (5) Tilleul-Buff and Vinaceous-Buff

Table 4: *Crocidura (flavescens) manni*. Variation of the skull length (CI) in relation to age groups and geographic origins. Means for samples larger than 1 (n = sample size).

Origin	♂ adult	♂ young adult	♂ juvenile	♀ adult	♀ young adult	♀ juvenile
Sudan savanna	34.9 n : 6	34.5 n : 4	31.5 n : 2	34.9 n : 8	—	32.4 n : 1
Guinea savanna	33.6 n : 3	33.1 n : 1	30.5 n : 1	31.9 n : 5	30.0 n : 1	29.0 n : 1
Derived savanna	35.1 n : 3	35.0 n : 1	31.8 n : 2	—	33.2 n : 3	32.5 n : 1
Rainforest zone	33.8 n : 8	33.5 n : 3	31.0 n : 3	32.9 n : 10	33.8 n : 1	31.4 n : 2
All zones	34.2 n : 20	34.0 n : 9	31.3 n : 8	33.4 n : 23	32.7 n : 5	31.4 n : 5

and in towns. The 34 localities plotted in Map 2 are randomly scattered all over the country.

**Natural history:** This very successful commensal species is found in many habitats including houses, food stores, banana plantations and farmlands as well as riverine habitats. These musk shrews are rarely found in rainforest and natural savanna so it is probable that their number and range have increased as more man-made habitats have become available. Despite their abundance little is known of their biology. Their bony remains have been found in owl pellets (Demeter 1978, 1981), so the strong scent does not appear to give protection from some nocturnal predators. They are probably very successful predators and scavengers, and remarkably fierce for their size. There are normally 4 young per litter in Nigerian Giant shrews (Happold, unpublished).



Map 2: Distribution of *Crocidura (flavescens) manni* and *C. odorata* in Nigeria.

**T a x o n o m y :** *Crocidura (flavescens) manni* is one of several closely related shrews of similar size which occur throughout Africa, and which (more or less) replace each other geographically (Heim de Balsac & Barloy 1966). *Crocidura flavescens* as defined in a recent review (Heim de Balsac & Meester 1977) includes several forms which were originally thought to be separate species but are now considered as subspecies. The Nigerian „subspecies” is *manni*, which was considered in many earlier work (eg. Rosevear 1953) as a valid species, *Crocidura manni*. It is rather unlikely that the small South African *flavescens* and the big West African form are conspecific; hence Meylan & Vogel (1982) used the name *occidentalis* for the West African species. They described the karyotypes of one shrew from Zonkwa and another from Okpuje ( $2N = 50$ ,  $NF = 66$ ) and found it to be identical with the karyotype of specimens from Ivory Coast, Mali, Cameroun and Zaire. As there exists no karyotypic study of the South African *flavescens*, these authors preferred to use the name *Crocidura occidentalis*.

The entire *C. flavescens* complex is in need of revision. Nevertheless, this complex is cranially quite well defined. Until a revision of the whole group we prefer the writing *Crocidura (flavescens) manni*, following the superspecies concept of Amadon (1966).



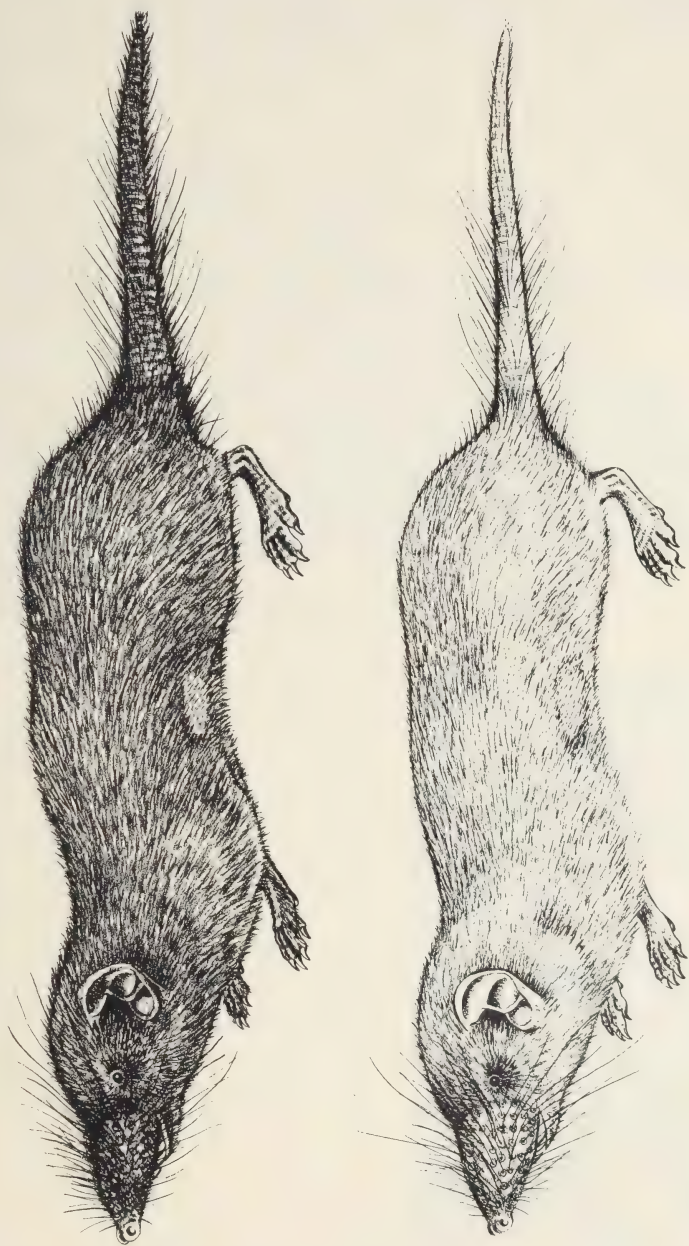


Fig. 25; African Giant shrews. Top: *Crocidura odorata*. Bottom: *Crocidura (flavescens) manni*. Drawn by Henry L. Norman. Slightly smaller than natural size.





Fig. 26: Head of the lectotype of *Crocidura (Crocid.) manni* Peters, 1878 (SMNS 1646 a).

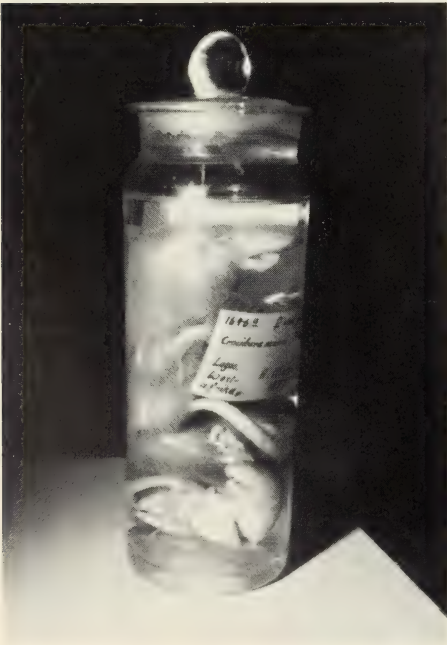


Fig. 27: Lectotype of *Crocidura (Crocid.) manni* Peters, 1878 from Lagos, Nigeria (SMNS 1646 a).

Peters (1878) described *Crocidura (Crocid.) manni* from three specimens (including a female with three young) collected by Mr. A. Mann near Lagos, Nigeria. The series formed part of the collections of the former 'Cabinet of Natural History' of Stuttgart. Today the type series is in the Museum für Naturkunde, Stuttgart and in the Museum für Naturkunde der Humboldt-Universität Berlin. It consists of three syntypes: an adult female and one juvenile in a jar preserved in alcohol, SMNS 1646a (Fig. 27) labelled „*Crocidura manni* Peters. Lagos, Westafrika, A. Mann 1877"; a mounted skeleton of an adult female, SMNS 1646b, labelled „*C. manni*, Peters 1878 Lagos, W. Afrika, Mann"; and an adult male preserved in alcohol, ZMB 5253, labelled „*Crocidura manni*, Lagos, Mann".

We designate here specimen SMNS 1646a as the lectotype (Figs. 26, 27) and SMNS 1646b and ZMB 5253 as lectoparatypes of *Crocidura (Crocid.) manni* Peters, 1878. The jar which contains the lectotype also contains one of the three juveniles noted by Peters (1878) in his original description. One of the other juveniles was formerly mounted but has been lost; only the label and the wooden cube on which it was mounted are still preserved in the Stuttgart museum (SMNS 1152a). The third juvenile has also been lost. The lectoparatype SMNS 1646b has a fine complete skull with CI 32.4, IW 6.0, MB 10.0, GW 13.2, UTR 14.6.

#### Specimens examined (196):

Abutshi, BMNH 5.12.1.5.; Afon, USNM 402296-402301; Aguleri, USNM 377081, 377085-6, 377093; Akpaka F. R., NHI; Aponmo F. R., NHI; Asaba, BMNH 95.5.3.1., USNM 377092; Awka, BMNH 12.2.29.1-3; Ayangba, BMNH 79.1057-8; Azara, BMNH 79.1068; Bauchi, BMNH 68.484; Dikwa, NHI 613/49; Farniso, BMNH 25.5.12.5., 1939.1550-2; Fika, USNM 378763-4; Filele, USNM 402302; Futuk, AD 1, 3-13, 15, 18, 21, 23, 28; Ibadan, BMNH 57.289, 28.1.26.9-10, 50.192-5, 62.251, DH 579-581, 886, 983, 1150, 1151, 1154, ZMC 1457-9, 1482, 1485-9, USNM 375934-5, 378765, 377087-9, 379498, 379477, 379476, 379478-379482, 379484-5, 402292-5; Igbo-Oloyin, DH 67.12, 67.13, 67.90, 67.133, 67.533; Igbo-Ora, USNM 377079, 377090-1; Ilashe, 4 miles south of, USNM 402243-5, 402225, 402229; Jemaa, BMNH 12.7.16.1.; Jos, NHI 583/49; Kano, BMNH 28.1.26.6-8; Karaduwa, USNM 402234-5, 402266-8; Katsina, BMNH 79.1066-7; Lagos, SMNS 1646a (lectotype), 1646b (lectoparatype), 1152, 1816a,b, ZMB 5253 (lectoparatype), BMNH 4.1.28.1, 15.1.2.1, 42.10.24.2, 24.11.5.1, 93.1.7.6, 14.7.25.1, 23.10.19.1, 26.11.24.4-7; Maiduguri, BMNH 28.12.30.1-2; Mamu River F. R., AM 1641, BMNH 76.1472-7, 78.828, 79.1050-3, 79.1061-5; Okpo, BMNH 79.1070; Okpuje, BMNH 79.1060, AM 1687, 1643; Olle, F. R., NHI 841/50; Oyo, BMNH 28.1.26.11-12; Panisau, USNM 402269-78, 402236; Pankshin, BMNH 79.1059, 79.1069; Panyam, BMNH 11.3.24.8, 12.7.9.1, USNM 402283-4, 375936-7; Toro, RNHL 30998-31003; Ugar Jabar, USNM 402279-82; Wikki, AD 97, 98; Zaria, HNHM 78.11.1; Zonkwa, AM 1643, BMNH 79.1054-6.

*Crocidura odorata* (Leconte)

Figs. 5, 25, Map 2

*Sorex odoratus* Leconte, 1857: 11; Cette Cama, Gaboon.

**D i a g n o s i s :** Size as in *manni*, pelage throughout dark-brown to blackish-brown (Fig. 25). The overall dark colour is the best character to distinguish this species from *Crocidura (f.) manni*. Tail thick at base, often well covered with long bristles. Skull (Fig. 5) very similar to that of *manni*, but less slender, with a more robust rostrum and maxilla. Glands in skin produce secretions which give a characteristic strong smell.

**M e a s u r e m e n t s :** Five adults (males and females) from various localities: HB 132-150, T 78-96, HF 21-23, E 12-15, WT 45-78, CI 31.5-37.3, IW 5.8-7.0, MB 10.0-11.8, GW 13.1-15.9, HCC 7.0-8.4, UTR 13.9-17.0.

**D i s t r i b u t i o n :** The small number of specimens in museum collections suggests that this species is much less common than *Crocidura (flavescens) manni*. The species was first recorded in Nigeria by Cozens & Marchant (1952), who collected two specimens at Owerri. Since then eleven new specimens have become available, representing seven new localities (Map 2).

**N a t u r a l h i s t o r y :** There is little ecological information on these large shrews. They have been found in yam and cocoa plantations, in riverine forests (Demeter 1981) and old farmlands, and (in the north) in houses. They have been also found as remains in owl pellets.

**T a x o n o m y :** The systematic position of the Black Giant shrews is still open to question. Apart from the colour differences, they are hardly distinguished from the other Giant shrew, *Crocidura (flavescens) manni*. They have same chromosome numbers (Meylan & Vogel 1982) and their defence calls are very similar (Hutterer & Vogel 1977). In West Africa, both species have a more or less sympatric distribution although in most localities they occur in different habitats. In Nigeria both were collected at Futuk, Ibadan and Wikki; however, it is not known whether both species were collected in exactly the same places.

The size of *C. odorata* varies from north to south. The few adults indicate a variation in size from large (in the south) to small (in the north). Fig. 25 was based on such a small example from the north. With the little material available we cannot assign the Nigerian specimens to one of the subspecies of the *C. odorata* complex. This is also difficult because of the fact that the limits of the *C. odorata* species/subspecies group have not yet been defined.

**S p e c i m e n s e x a m i n e d (12):**

Dada, USNM 402303-5; Futuk, AD 2; Ibadan, DH 886, 1149; Ikom, BMNH 76.1471; Owerri, BMNH 50.823-4; Tangaza, USNM 402246; Umuahia, BMNH 52.97; Wikki, HHNM 4487.

## Dark Forest and Swamp Shrews of Large Size

### *Crocidura buettikoferi* Jentink

Fig. 6, Map 3

*Crocidura büttikoferi* Jentink, 1888: 47; Robertsport, Liberia.

**D i a g n o s i s :** Medium-sized to large shrews. Dorsal pelage deep chocolate-brown; ventral pelage paler or greyish-brown. Limbs dark. Tail dark, very sparsely covered with hairs and bristles; about 70 % of HB. Skull (Fig. 6) with a slightly domed braincase, nearly oval in dorsal view. Skull smaller and more slender than in the similar *Crocidura poensis*.

**M e a s u r e m e n t s :** Three females from Umuahia: HB 72-100.5, T 51-62, HF 12-15, E 7-9.5, WT -, CI 21.4-22.7, IW 4.9-5.1, MB 6.7-7.1, GW 9.2-9.9, HCC 5.2-5.8, UTR 10.0-10.1.

**D i s t r i b u t i o n :** This species is recorded here for the first time from Nigeria, although specimens have been in the collections of the British Museum for 80 years. W. G. Ansorge collected the first example at Agberi on 14 July, 1902. I. T. Sanderson collected one at Nko on 4 July, 1933, which he published under the name *Crocidura occidentalis nigeriae* (Sanderson 1940: 680). Further specimens were obtained by S. Marchant at Owerri and by A. B. Cozens at Umuahia; these were also referred to as *occidentalis nigeriae* (Cozens & Marchant 1952). Outside Nigeria, the species was only known by the holotype from Liberia, by some skulls from owl pellets collected at Gouécke, Guinea (Heim de Balsac 1958), and by some specimens from Portuguese Guinea (Heim de Balsac 1968 a).

**N a t u r a l h i s t o r y :** According to collectors' notes, *C. buettikoferi* lives in grassland habitats in the rainforest zone rather than in forest habitats.

**T a x o n o m y :** The Nigerian specimens have been compared with the holotype skull of *Crocidura buettikoferi*, which Dr. Chris Smeenk kindly sent to the first author for comparison. They agree fully with the holotype (a photograph of which was published by Heim de Balsac 1958), so there is no doubt that the Nigerian specimens belong to this rare species. In a recent review (Heim de Balsac & Meester 1977), two subspecies are recognized, *buettikoferi* and *attila*. Hutterer & Joger (1982) have shown that *Crocidura attila* is likely to be a separate species characterized by its smaller size. There is a clear distinction between the larger *buettikoferi* in Nigeria and the smaller *attila* in Cameroun and Zaire; no intergrades have been found. We conclude that *Crocidura buettikoferi* is endemic to the West African region.

**S p e c i m e n s e x a m i n e d (6):**

Agberi, BMNH 2.11.2.7; Nko, BMNH 48.759; Owerri, BMNH 66.2850; Umuahia, BMNH 52.99, 52.100, 46.285.



*Crocidura poensis* (Fraser)

## Fig. 7, Map 3

*Sorex (Crocidura) Poensis* Fraser, 1843 (for 1842): 200; Clarence, Fernando Po. — *Rhinomys soricoides* Murray, 1860: 159; Old Calabar, Nigeria. — *Crocidura occidentalis calabarensis* Sanderson, 1940: 681; Calabar, Nigeria.

**D i a g n o s i s :** Dark-brown to blackish-brown shrews; ventral pelage similar tending to greyish-brown. Fore and hind limbs dark. Tail thin and dark, with sparse long thin bristles. Skull (Fig. 7) smaller and with a less straight profile than in the similar *Crocidura nigeriae*.

**M e a s u r e m e n t s :** Eight specimens, males and females, from Owerri, south-eastern Nigeria: HB 87-102, T 54-64, HF 12-15, E 9-11, WT -, CI 23.7-24.5, IW 4.7-5.1, MB 6.0-7.5, GW 10.1-10.5, HCC 5.9, UTR 9.7-11.1. A female from Panyam, Jos plateau: HB 75, T 50, HF 14, E 7, WT 9.9, CI 22.9, IW 4.8, MB 7.3, GW 10.0, HCC 5.9, UTR 10.1.

**D i s t r i b u t i o n :** The species is widespread in the rainforest zone, relic forests in derived savanna, and Jos plateau (Map 3).

**N a t u r a l h i s t o r y :** These shrews occur mainly in the rainforest zone, although they are also known from the Jos plateau and a few other places north of the rainforest zone. They live in various types of grasslands, and in some farmlands. At Owerri, they live in farmlands and open grassland within the rainforest zone, as described by Cozens & Marchant (1952). The diet of *Crocidura poensis* has been studied by Churchfield (1982) at Oron: major dietary items included gryllids, diplopods, coleopterans and hemipterans. In addition, captive shrews readily ate acridids and mantids. 48 % of prey items were 5—10 mm in body length but invertebrates up to 50 mm in length were taken by captive shrews.

**T a x o n o m y :** *Crocidura poensis* was first described from Fernando Po in the Gulf of Guinea. The island also supports a similar but larger shrew, *Crocidura nigeriae*, originally described from Nigeria. As the original specimen of *Crocidura poensis* is not preserved, it is uncertain whether it was *Crocidura poensis* or *Crocidura nigeriae*; consequently the smaller species is normally referred to as *C. poensis* and the larger as *C. nigeriae* (Heim de Balsac 1968 b). The taxa *soricoides* and *calabarensis* are also referred here. The holotype of *Rhinomys soricoides* (BMNH 63.12.17.6) is poorly preserved; it consists of a shrunken skin with parts of the skull extracted. The colour of the skin is apparently faded, as already mentioned by Dollman (1915), but is brownish all over. One of us (RH) took the following measurements from the skull: IW 4.9, MB 7.1, UTR 10.9, which lie within the range of the species as understood here. The holotype of *Crocidura occidentalis calabarensis* (BMNH 39.321) is a juvenile and consists of a skin and skull in fairly good condition. The colour of the skin is deep blackish-brown, limbs, tail and ears are also blackish. The skull measures: CI 24.1, IW 5.0, MB 7.4, GW 9.8, HCC 5.9, UTR 10.9. Its measurements also fit well in the range of *C. poensis*. The blackish-



brown colour of the type specimen is also present in another specimen, BMNH 48.758, collected by I.T. Sanderson on 3 July, 1933 at Nko.

**Specimens examined: (49):**

Aguleri, USNM 377075, 377082; Bida, USNM 402249, 402250; Calabar, BMNH 63.12.17.6 (holotype of *soricoides*), 39.321 (holotype of *calabarensis*), 74.5.28.3; Futuk, AD 19, 22, 24, 25, 34, 39, 52; Ibadan, ZMC 1456; Ikom, BMNH 76.1480-1; Lagos, BMNH 28.1.26.13; Nde, BMNH 76.1479; Nko, BMNH 48.758, 48.761; Oban, USNM 377061, 377067; Okpo, BMNH 79.1071; Oron, SC, not numbered; Osa, BMNH 52.103-5; Owerri, BMNH 50.825-6, 50.831, 66.2840-1, 66.2846, 66.2848, one not numbered; Panyam, NMW 8341; Toro, RNHL 30986-30992; Umuhia, BMNH 52.98, 52.101; Wikki, AD 102, 107, 108.

***Crocidura nigeriae* Dollman**

Fig. 8, Map 3

*Crocidura occidentalis nigeriae* Dollman, 1915: 511, 524; Asaba, Nigeria.

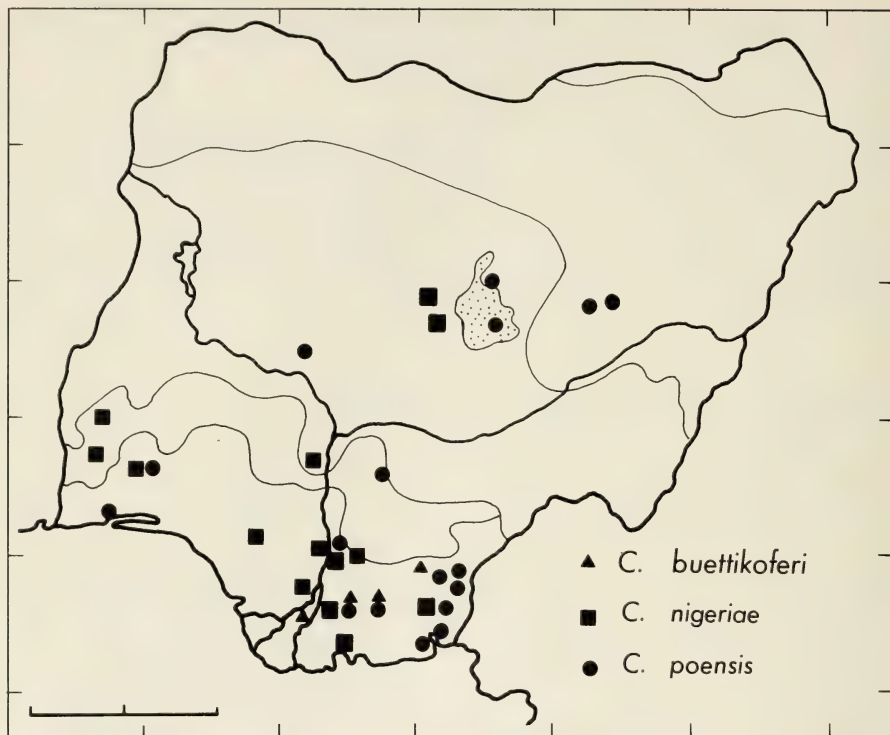
**Diagnosis:** Large shrews with long extremities. Dorsal pelage deep chocolate-brown; ventral surface dark grey or greyish-brown. Tail fairly long and dark, with small black hairs and scattered long bristles on basal half; approximately 65 % of HB. Pelage usually less dark than in *Crocidura poensis*. Very similar in size and colour to *C. longipes*, *C. grandiceps* and *C. foxi*. Karyotype:  $2N = 50$ ,  $NF = 76$  (Meylan & Vogel 1982). Skull (Fig. 8) large, flat in profile, with a broad maxillary region and a broad braincase. Third upper molar large, not reduced.

**Measurements:** The holotype from Asaba: HB 98, T 67, HF 15.5, E 9.5, CI 25.9, IW 5.1, MB 7.8, GW 10.5, HCC 6.8, UTR 11.5. Three adult males from Ilashe: HB 106-110, T 64-69, HF 18, E 10-11, WT 22-25, CI 24.7-25.5, IW 5.2-5.4, MB 7.8, GW 10.5-10.7, HCC 5.8-6.2, UTR 10.6-11.1.

**Distribution:** Widespread in rainforest zone and parts of derived savanna (Map 3). Occurs also in Cameroun and Bioko (Fernando Po).

**Natural history:** These shrews live mainly in rainforest habitats. Records on specimen labels indicate that specimens were taken in rainforests, farmlands in the rainforest zone and grassfields. There is little information on the biology of these shrews, due to identification problems.

**Taxonomy:** This species has been referred to previously as *Crocidura occidentalis nigeriae* (e.g. Rosevear 1953) and *Crocidura poensis nigeriae* (e.g. Heim de Balsac & Meester 1977). Heim de Balsac (1968 b, and previous papers) was the first to recognize that *Crocidura nigeriae* was a species different from *occidentalis* and *poensis*. He also noticed that in Cameroun and on the island of Fernando Po, there were two similar forms, *C. poensis* and *C. nigeriae*, but he did not describe the distinguishing characters of the two species. The situation is more complicated due to the fact that both species show considerable variation in colour. For instance, specimens from Cameroun are



Map 3: Distribution of *Crocidura buettikoferi*, *C. nigeriae* and *C. poensis* in Nigeria.

much darker than those from Nigeria. The best characters to distinguish both forms are the size and shape of the skull (Figs. 7, 8). An important contribution towards a clarification of the taxonomic situation is the work of Meylan & Vogel (1982). They report on karyotypes of five specimens of *Crocidura nigeriae* from Zonkwa and Mamu River Forest Reserve, Nigeria. All have the same karyotype,  $2N = 50$ ,  $NF = 76$ , which is different from that of *Crocidura poensis pamela* from Ivory Coast, with  $2N = 52$ ,  $NF = 70$ . Unfortunately no karyotypes are available from specimens collected on Fernando Po and in Cameroun. Final conclusions on the taxonomy of this difficult group require karyological data from those regions.

#### Specimens examined (61):

Aguleri, USNM 377076; Asaba, BMNH 95.5.3.2 (holotype); Ashaka, USNM 377065-6, 377069, 377071-4; Benin, 30 miles west of, USNM 377062-3; Ibadan, BMNH 50.196, ZMC 1484, 1490; Idere, DH 695, 696; Igbo-Ora, DH 682; Ilashe, USNM 402223, 402226, 402228, 402230, 402232; Mamu River F. R., AM 1640, BMNH 76.1478; Oban, USNM 377077, 377083, 377084; Oke-Iho, DH 860; Okpuje, AM 1642; Oyakama, near Port Harcourt, LS 1-19, ZFMK 82.115-8; Ugar Jabar, USNM 402287-8; Umuahia, BMNH 46.284, 78.829; Zonkwa, AM 1685, 1686, 1691, 1708, 1709.

*Crocidura longipes* new species

Fig. 9

**H o l o t y p e :** Skin and skull of an adult male, USNM 402309, both in good condition; collected by J. C. Geest on 2 July 1967 at Dada (11.34 N, 4.29 E), western Nigeria.

**P a r a t y p e s :** USNM 402307, male, and USNM 402306, 402308, females, same data as for the holotype; USNM 402247, 402248, males, collected by J. C. Geest on 12 December 1966 at Iella, two miles east of Bahindi (11.28 N, 4.11 E). All paratypes are skins and skulls in good condition except for the skull of USNM 402247 which is damaged.

**D i a g n o s i s :** Large chocolate-brown shrews with very long hindfeet (18—19) and a sparsely haired tail. Dorsal and ventral surfaces, hands, feet and tail uniformly dark brown. The skull (Fig. 9) is long and pointed, interorbital and maxillary region narrow. Rostrum also long and narrow. Dentition weak, particularly the upper molars. Mandible lightly built, with a long and thin angular process.

**M e a s u r e m e n t s :** Four males and two females, the type series: HB 95-111, T 50-69, HF 18-19, E 10-12, WT 15-24, CI 24.2-25.4, IW 5.0-5.3, MB 7.1-7.5, GW 10.1-10.8, HCC 6.0-6.5, UTR 10.7-10.9; see also Table 5.

Table 5: Measurements of *Crocidura longipes* new species

USNM No.	sex + age	HB	T	HF	E	WT	CI	IW	MB	GW	HCC	UTR
402309, holotype	♂ ad.	111	69	18	12	24	25.2	5.2	7.5	10.8	6.5	10.9
402307	♂ ad.	109	69	19	11	21	25.4	5.2	7.3	10.7	6.0	10.8
402306	♀ ad.	112	64	18	10	20	24.9	5.3	7.5	10.4	6.4	10.7
402308	♀ ad.	101	63	18	12	20	24.7	5.1	7.2	10.1	6.3	10.7
402310	♀ juv.	80	47	16	11	6	—	—	—	—	—	—
402247	♂ juv.	95	56	18	10	16	—	5.2	7.1	—	—	10.3
402248	♂ juv.	100	50	18	11	15	24.2	5.0	7.2	10.2	6.1	10.7

**D i s t r i b u t i o n :** The new species is only known from two localities in western Nigeria, Dada and Iella (2 miles east Bahindi).

**N a t u r a l h i s t o r y :** These shrews have only been found in swamps in dry Guinea savanna. A short description of the two localities taken from the field notes of the collector, Mr. J. C. Geest, was provided by Dr. C. Brian Robbins of the National Museum of Natural History, Washington: „**Iella** — the area is described as a marsh with palm trees and scattered other trees 6 m to 12 m tall. Soil gray in color with silt-clay mixture. Tall grasses near the marsh 1 to 2 m tall. Two brown-black *Crocidura* were caught near the water edge. **Dada** — another swamp area where 8 shrews, all red-brown, were caught. They were of two different kinds and separated by the ratio of

head and body length to tail length.” — The second species recognized by the collector was *Crocidura odorata*.

The new species may occur in many swamps along major river systems, for example in the Kainji Lake National Park, which is not very far from the localities where *Crocidura longipes* was collected.

**C o m p a r i s o n s :** The Latin *longipes* means long foot; it is this character that distinguishes this isolated species from several other species belonging to the group of large dark-brown shrews occurring in Nigeria. Table 6 summarizes some external and a few cranial measurements of six similar species which might be confused. It is evident from this Table that the length of the hindfoot serves to separate *Crocidura longipes* from all but *C. nigeriae* and *C. grandiceps*. Although there are small differences between these three species in external size and proportions, the main differences are in the skulls. *Crocidura grandiceps* has a larger skull and is separated from the remaining two species by size alone. The skulls of *C. longipes* and *C. nigeriae* are similar in size, but not in proportions. Compared to *C. nigeriae* (Fig. 8), the skull of *C. longipes* (Fig. 9) is more pointed, as expressed by the narrowness of its rostrum, maxillary and inter-orbital constriction. The dentition is much weaker in *C. longipes* and the tooththrows are shorter than in *C. nigeriae*. There are some similarities between the skulls of *C. longipes* and *C. wimmeri*, Heim de Balsac & Aellen, 1958, but the latter species has an ash-grey pelage and short hindfeet (see Hutterer 1983 a), whereas *C. longipes* has a dark-brown pelage and very long hindfeet. For the moment, we regard *Crocidura longipes* as an iso-

Table 6: Some external and cranial measurements of six similar dark brown shrews; means and extremes of variation (n = sample size).

	<i>C.buettikoferi</i>	<i>C.poensis</i>	<i>C.foxi</i>
HB	81 ( 72-100 ) n:5	93 ( 84-102 ) n:16	90 ( 58-104 ) n:17
T	56 ( 51- 62 ) n:5	57 ( 51- 64 ) n:14	54 ( 43- 65 ) n:17
HF	14 ( 12- 15 ) n:5	14.2 ( 12- 16 ) n:16	14.3 ( 12- 17 ) n:17
E	8.5 ( 7- 9.5 ) n:4	9.5 ( 6.5- 11 ) n:15	10.5( 9- 12 ) n:17
WT	—	16.5 ( 16- 17 ) n:2	18.5 ( 14- 22 ) n:6
CI	22.2 (21.4-22.7) n:3	23.7 (23.0-24.5) n:9	24.8 (24.2-25.1) n:10
MB	6.9 ( 6.7- 7.1 ) n:5	7.2 ( 6.0- 7.7 ) n:16	7.7 ( 7.3- 8.0 ) n:15
UTR	10.1 ( 9.9-10.3 ) n:5	10.3 ( 9.5-11.1 ) n:16	10.7 (10.3-11.1) n:17

	<i>C.nigeriae</i>	<i>C.longipes</i>	<i>C.grandiceps</i>
HB	101 ( 97-110 ) n:11	105 ( 95-111 ) n:6	117 ( 98-119 ) n:19
T	64 ( 56- 69 ) n:11	62 ( 50- 69 ) n:6	65 ( 55- 74 ) n:19
HF	17.5 ( 16- 19 ) n:9	18.2 ( 18- 19 ) n:6	18.1 ( 17- 19 ) n:19
E	10 ( 9- 12 ) n:11	11 ( 10- 12 ) n:6	11( 10- 12 ) n:18
WT	19.7 ( 16- 25 ) n:10	19.3 ( 15- 24 ) n:6	23.5 ( 19- 27 ) n:18
CI	24.8 (23.7-25.5) n:8	24.9 (24.2-25.4) n:5	26.1 (25.4-27.4) n:15
MB	7.7 ( 7.4- 7.8 ) n:8	7.3 ( 7.1- 7.5 ) n:6	8.0 ( 7.7- 8.5 ) n:14
UTR	10.7 (10.0-11.1) n:9	10.7 (10.3-10.9) n:6	11.4 (10.6-11.7) n:17



lated form with uncertain affinities. It is possibly restricted to a very special habitat: swamps and marshes within the dry savanna zones.

**S p e c i m e n s e x a m i n e d (7):**

Dada, USNM 402306-402310; Iella, 2 miles east Bahindi, USNM 402247-8.

***Crocidura grandiceps* Hutterer**

Fig. 10

*Crocidura grandiceps* Hutterer, 1983 a: in press; Krokosua Hills, Ghana.

**D i a g n o s i s :** A large species of the *Crocidura poensis/nigeriae* species group with long tail (about 75 % of HB), long hindfoot, and a very large skull; CI up to 27.4. Dorsal pelage clove-brown, ventral pelage slightly paler, near hair-brown. Tail also brown, covered with long bristles on proximal half. Hands and feet dark brown. Externally the species is hardly distinguishable from *Crocidura nigeriae*. Skull larger than in *C. nigeriae* or any other species of this group (Table 6). Skull more slender than in *C. nigeriae*, braincase more oval in dorsal view. The number of chromosomes (Meylan & Vogel 1982; see also Table 1) is different from that of *C. nigeriae*.

**M e a s u r e m e n t s :** Nineteen adults, males and females: HB 98-119, T 55-74, HF 17-19, E 10-12, WT 19-27, CI 25.4-27.4, IW 5.0-5.7, MB 7.7-8.5, GW 10.6-11.7, HCC 6.0-6.5, UTR 10.6-11.7.

**D i s t r i b u t i o n :** The species is known from the southern rainforest zone of Ivory Coast, Ghana, and Nigeria (Hutterer 1983 a). In Nigeria, five localities are known, but it is likely that the species occurs elsewhere too. We have no records from east of the Niger River where *C. nigeriae* and *C. poensis* are abundant. At Ashaka, Ibadan, Ilashe and Lagos, *C. grandiceps* occurs together with *C. nigeriae*, *C. poensis*, and/or other shrews.

**N a t u r a l h i s t o r y :** Not much information, due to identification problems. Specimens have been caught mainly in high forest regions. At least some of the specimens reported by Happold (1975) were this species.

**T a x o n o m y :** See Hutterer (1983 a).

**S p e c i m e n s e x a m i n e d (22):**

Ashaka, USNM 377070, 377080; Gambari F. R., DH 649, 653, 1219, 1751; Ibadan, USNM 379483, 379491, 379499; Ilashe, USNM 402221-2, 402224, 402227, 402231; Lagos, USNM 402214-402220, BMNH 26.11.24.69.

***Crocidura*, unidentified species**

A number of specimens belonging to the *poensis/nigeriae* species group could not be identified to species level, mostly because of the fragmentary condition of the speci-



mens, or because they were not available at the final stage of this work. All belong to the group of uniform dark brown shrews and might be assigned to the species *C. poensis*, *C. nigeriae*, *C. grandiceps*, or *C. foxi*. We list the material here to make it available for further studies.

#### Specimens examined (37):

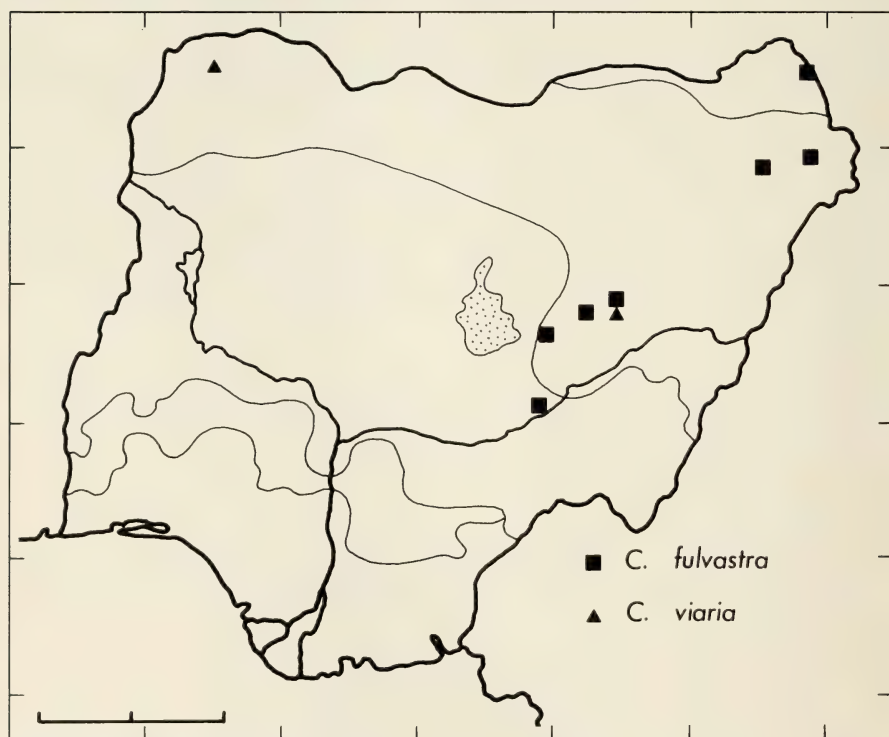
Awka, BMNH 12.2.29.13, 32.3.4.1; Baiku, BMNH 82.3.7.1; Ibadan, BMNH 28.1.26.13; Igbo-Oloyin, DH 67.14; Igbo-Ora, USNM 402206; Lagos, BMNH 12.10.24.3, 20.3.18.6-8, 20.4.28.5-6, SMNS 1815, 1241; Nko, BMNH 48.760; Oban, 15 miles west of, BMNH 10.6.1.11; Panyam Fish Farm, USNM 402285; Sapoba, DH 1362, USNM 377064, 377078, 379486-379490, 379492-379497, 402207, 402209-402213.

### Pale Savanna Shrews of Large Size

#### *Crocidura viaria* (I. Geoffroy Saint-Hilaire)

Fig. 11, Map 4

*Sorex viarius* I. Geoffroy Saint-Hilaire, 1834: 127; Senegal, restricted to the region between Dakar and St. Luis by Hutterer (1983 b).



Map 4: Distribution of *Crocidura fulvastra* and *C. viaria* in Nigeria.

**D i a g n o s i s :** Medium to large-sized, pale savanna shrews. Dorsal pelage fawn to drab, somewhat dappled because of its dark greyish hair bases; ventral pelage near neutral grey. Fur soft and long. Tail bicolored, dark dorsally, densely covered with long bristles. Skull flat and broad (Fig. 11), interorbital constriction short and fairly narrow. Zygomatic process of maxilla smooth. First upper incisor, upper molars and premolars large.

**M e a s u r e m e n t s :** Two females from Tangaza: HB 93, 98, T 57, 57, HF 16, 16, E 11, 11, WT 16, 18, CI 23.8, 24.2, IW 5.0, 4.9, MB 7.6, 7.7, GW 10.1, 10.5, HCC 5.5, 5.6, UTR 10.6, 10.7.

**D i s t r i b u t i o n :** These shrews are widely distributed in the savanna zones of Africa, from southern Morocco to the coast of Kenya. In Nigeria the species was only recently recorded from two localities (Hutterer 1983 b).

**N a t u r a l h i s t o r y :** The specimen from Futuk was found in owl pellets.

**T a x o n o m y :** The taxonomic status of these shrews is somewhat confusing. It appears that *C. viaria* is the valid name for the species which was previously called *C. hindei*, *C. bolivari*, or *C. suahelae* (Hutterer 1983 b). The specimen referred to by Rosevear (1953) as *C. hindei diana* from the shores of Lake Chad is probably *C. fulvastra*.

**S p e c i m e n s e x a m i n e d (3):**

Futuk, AD 117; Tangaza, USNM 402251-2.

### *Crocidura fulvastra* (Sundevall)

Fig. 12, Map 4

*Sorex fulvaster* Sundevall, 1843: 172; Bahr el Abiad, Sudan. — *Crocidura arethusa* Dollman, 1915: 514, 144; Kabwir, Nigeria. — *Crocidura hindei diana* Dollman, 1915: 512, 76; Lake Chad, Nigeria.

**D i a g n o s i s :** Medium-sized savanna shrews smaller than *Crocidura viaria*. Dorsal pelage light brown to cinnamon; hairs bluish-grey tipped with cinnamon. Ventral pelage and flanks whitish-grey clearly delineated from dorsal pelage; hairs grey with white tips. Tail brownish, covered with long white bristles; about 60 % of HB. Skull long and narrow in general shape, with long rostrum, narrow interorbital constriction and a narrow braincase (Fig. 12). Zygomatic process of maxilla angular. Upper incisors long and sharp, passing straight downwards. Upper premolars and molars narrow compared to *C. viaria*, *C. lamottei* and *C. butleri*.

**M e a s u r e m e n t s :** Five females from northern Nigeria: HB 86-94, T 49-55, HF 14-15, E 10-11, WT 10-18, CI 21.1-22.7, IW 4.5-5.1, MB 6.6-7.2, GW 9.1-9.7, HCC 5.1-5.6, UTR 8.9-10.0; four males from the same region: HB 99-120, T 57-64, HF 14-

17, E 12-13, WT 16-29, CI 23.6-25.7, IW 4.5-5.0, MB 7.3-7.7, GW 10.0-10.6, HCC 7.3-7.7, UTR 10.0-10.8. This species shows a remarkable sexual dimorphism.

**Distribution:** Occurs quite frequently in the Sudan and Sahel savannas. Its overall distribution was reviewed by Hutterer (1983 b). Recent records are known from Mali, Nigeria, Sudan, Ethiopia and Kenya.

**Natural history:** These shrews occur in the drier savanna zones although it is likely that they live in mesic habitats such as swamps, damp grasslands, riverine forests and perhaps rocky areas. Remains of some individuals have been found in owl pellets in and close to Yankari Game Reserve (Hutterer & Jenkins 1980).

**Taxonomy:** *Crocidura fulvastra* is the correct name for this species, formerly referred to as *Crocidura arethusa* and *Crocidura sericea* (Rosevear 1941, 1953, Heim de Balsac & Meester 1977). The specimen recorded from Lake Chad (between Jo and Bosso; Bates 1927) and named *Crocidura hindei diana* (Dollman 1915, Rosevear 1953) belongs to this species. The holotypes of *arethusa* and *diana* have been compared with Sudanese specimens of *fulvastra* and found to be identical. For a complete synonymy, see Hutterer (1983 b).

#### Specimens examined (19):

Dikwa, 31 miles north-east, USNM 378753-378761; Futuk, AD 27, 29, 40; Ibi, north of, BMNH 7.7.8.51; Kabwir, BMNH 14.11.8.2 (holotype of *arethusa*), 14.11.8.1; Lake Chad, BMNH 7.7.8.50 (holotype of *diana*); Maiduguri, BMNH 28.12.30.3; Wikki, AD 103, 104.

### *Crocidura butleri* Thomas

Fig. 13

*Crocidura butleri* Thomas, 1911: 375; between Chakchak and Dem Zubeir, Bahr el Ghazal, Sudan.

**Diagnosis:** Medium-sized shrews. Dorsal pelage cinnamon to greyish-brown; hairs grey with cinnamon tips. Ventral pelage and flanks yellowish-grey; hairs grey with creamy-yellow tips. Tail very short and broad, pale with scattered pale hairs; about 35 % of HB (description of specimen from Sudan). Skull (Fig. 13) in dorsal view similar to an hour-glass, with large incisors, broad molars, and a very thin third upper molar; this molar showing a special configuration: paracone, metacone and protocone form nearly an equilateral triangle (see figure in Hutterer & Kock 1983).

**Measurements:** A fragmentary skull from Futuk: IW 4.5, MB 7.6, UTR 10.8.

**Distribution:** Three skulls from Futuk collected by A. Demeter represent the first record of *Crocidura butleri* from Nigeria. The species is very rare in collections and probably also in nature, considering the small percentage in owl pellets (1,6 % of

all shrews in Kordofan, Sudan: Hutterer & Kock 1983). Butler's shrews have been recorded from Sudan, Somalia and Kenya but not previously as far west as Nigeria.

Natural history: Nothing is known about their habits.

Taxonomy: The few specimens from Futuk are in full accordance with the holotype of *Crocidura butleri*.

Specimens examined (3):

Futuk, AD 14, 26, 42.

*Crocidura lamottei* Heim de Balsac

Fig. 14, Map 5

*Crocidura lamottei* Heim de Balsac, 1968 a: 385; Lamto, Ivory Coast.

Diagnosis: Medium-sized shrews. Dorsal pelage light brown to grey-brown; hairs bluish-grey with brown tips. Ventral pelage medium-grey. Limbs pale with short



Map 5: Distribution of *Crocidura foxi* and *C. lamottei* in Nigeria.

white hairs and scattered long bristles. Tail broad at base, narrowing towards tip, with short white hairs and long bristles; about 53 % of HB. Tail paler than the body. Skull (Fig. 14) with a similar configuration as in *Crocidura butleri*, but larger. Molars broad, first upper incisors heavy, and third upper molars with a special shape as described for *Crocidura butleri*. Mandible (Fig. 14) very heavy, particularly the coronoid process.

**Measurements:** Two males and one female: HB 93-103, T 52-55, HF 15-16, E 11-12, WT 18-23, CI 24.7-25.8, IW 4.7-5.4, MB 8.1-8.8, GW 10.1-10.6, HCC 5.7-6.2, UTR 11.1-11.5.

**Distribution:** This is the first record of *Crocidura lamottei* from Nigeria. The species was previously known from Ivory Coast, Liberia, perhaps Togo (Heim de Balsac & Meester 1977), and Senegal (Hutterer 1981 a).

**Natural history:** The specimen from Kabba was found amongst dry grasses on a rocky hillside. The three Nigerian specimens are all from the derived savanna zone (Map 5).

**Taxonomy:** The skulls of the Nigerian specimens agree very well with the holotype of the species (figured by Heim de Balsac 1968 a). There exists obviously some variation in colour from north to south, but there is too little material in collections to understand this variation.

**Specimens examined (3):**

Igbo-Ora, USNM 402208; Kabba, DH 1570; Upper Ogun ranch, USNM 402233.

### *Crocidura foxi* Dollman

Fig. 15, Map 5

*Crocidura foxi* Dollman, 1915: 514, 143; Panyam, Nigeria.

**Diagnosis:** Similar in size to *Crocidura poensis* and *Crocidura nigeriae*, but paler and greyer in colour. Dorsal pelage pale chocolate-brown to russet-brown; hairs grey at base with brown tips. Ventral pelage, flanks, chest and throat grey, clearly delineated from dorsal pelage; hairs sometimes with white tips. Tail short and pale, with short hairs and numerous long bristles; about 57 % of HB. Skull (Fig. 15) similar to that of *C. poensis* and *C. nigeriae*, but with a flatter braincase and a longer and narrower interorbital region. Upper molars broad, third upper molar thin and small, and sometimes showing a similar configuration as that observed in *C. lamottei* and *C. butleri*.

**Measurements:** The holotype from Panyam, an adult female: HB 98, T 61, HF 15, E 12, CI 24.6, IW 5.3, MB 7.4, GW 10.7, HCC 6.2, UTR 11.0. Fourteen specimens, males and females, adults and young adults, from Owerri: HB 58-104, T 46-55, HF 11-14, E 9-12, CI 24.2-25.2, IW 4.8-5.3, MB 7.4-7.9, GW 10.1-10.5, HCC 5.7-5.8,



UTR 10.3-11.0. Two males and one female from two miles north Panyam: HB 83-102, T 62-64, HF 16-17, E 11, WT 14-20, CI 24.7, IW 5.1, MB 7.5, GW 10.5, HCC 5.9, UTR 10.4-11.0.

**Distribution:** Derived and Guinea savanna zones, and on Jos plateau (Map 5). There are no records of *Crocidura foxi* outside Nigeria.

**Natural history:** Little is known about these shrews. They have been found in long grass, secondary bush, near to farmlands, and in rocky grasslands which had been recently burnt. Cozens & Marchant (1952), who obtained a fine series of *Crocidura foxi* at Owerri, noted about this species (under the name *Crocidura occidentalis nigeriae*): „Extremely abundant at Owerri, thirty-two specimens being obtained. Although nothing precise is known about the habitat, they probably favour secondary growth and cleared land.” Among the series obtained by these authors were also *Crocidura buettikoferi*, *Crocidura nigeriae* and *Crocidura poensis*. It appears to us that *Crocidura foxi* is not a member of the rainforest fauna but a savanna shrew invading cleared land in the rainforest zone. This would be similar to the pale *Crocidura theresae* from Ivory Coast, which sometimes occurs sympatrically with the dark *Crocidura poensis* along the forest-savanna boundary (Heim de Balsac 1968 a, Hutterer & Vogel 1977).

**Taxonomy:** If our view of *Crocidura foxi* is correct, then the species is a member of the savanna shrews, comprising *Crocidura butleri*, *C. lamottei* and others. This view is supported by the flat and broad shape of the skull, and by the shape of the third upper molar. This tooth is somewhat reduced, in contrast to that of *C. poensis* and *C. nigeriae*. The series of *Crocidura foxi* from Owerri is very uniform in its pale greyish pelage and the short and densely haired tails. This series is similar to *Crocidura theresae* Heim de Balsac, 1968 from Ivory Coast, but differs in its measurements; *Crocidura foxi* is larger than *Crocidura theresae*, although they seem to be related, a view that was shared by the late Professor Heim de Balsac.

**Specimens examined:** (31):

Futuk, AD 16, 20, 116, 118; Kabwir, USNM 375931, 375933; Owerri, BMNH 50.827-50.830, 50.832, 66.2839, 66.2842-5, 66.2847, 66.2849, 66.2851, one unregistered; Panyam, BMNH 11.3.2.4.7 (holotype of *foxi*); Panyam, two miles north, USNM 375929, 375930, 375932; Toro, RNHL 30993-30997; Umuahia, BMNH 52.102; Wikki, AD 101.

## Forest-Savanna Shrews of Medium Size

### *Crocidura crossei* Thomas

Fig. 16, Map 6

*Crocidura (Cr.) crossei* Thomas, 1895: 53; Asaba, Nigeria.

**D i a g n o s i s :** Small to medium-sized shrews. Dorsal pelage greyish-brown to pale chocolate-brown. Ventral pelage paler or greyish in rainforest individuals, light-grey in some derived savanna individuals. Tail dark with small dark hairs and very sparse long bristles; about 84 % of HB. Limbs usually dark with short hairs. Skull (Fig. 16) long with a flat braincase. Dorsal profile of skull angular, sometimes with a marked mid-dorsal break (also present in *Crocidura douceti*). Rostrum slender, maxillary region narrow.

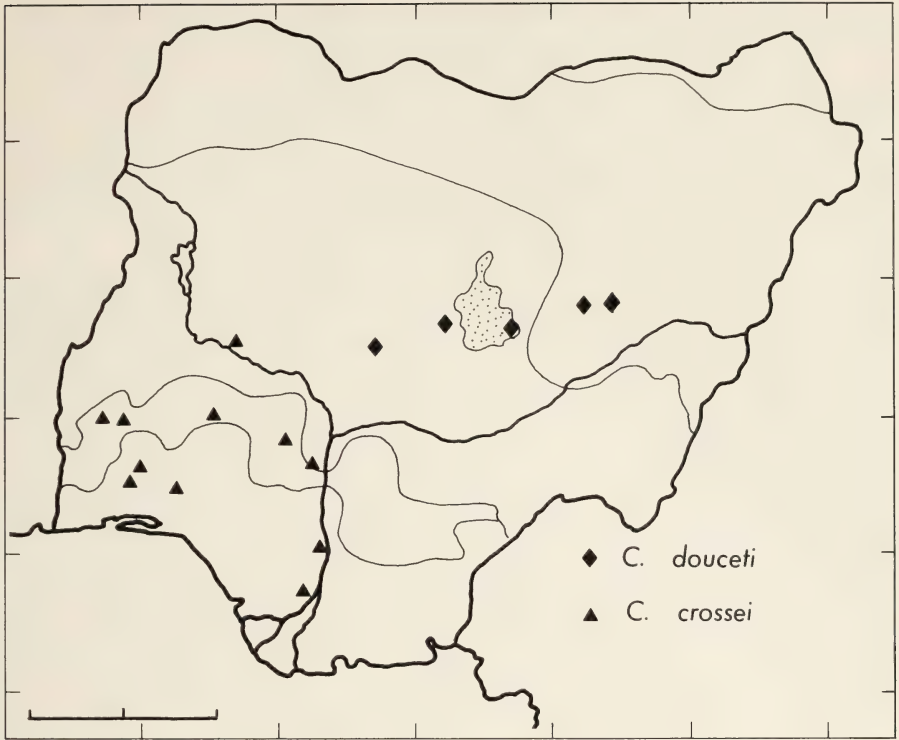
**M e a s u r e m e n t s :** Ten specimens from Gambari Forest Reserve, males and females: HB 54-80, T 48-57, HF 10-12, E 6-8, WT 6.3-8, CI 18.5-19.9, IW 4.0-4.4, MB 5.5-6.0, GW 7.8-8.5, HCC 4.4-4.7, UTR 7.7-8.6.

**D i s t r i b u t i o n :** Rainforest zone, and relic forests in derived savanna of western Nigeria (Map 6). Probably occurs in similar habitats in eastern Nigeria.

**N a t u r a l h i s t o r y :** Crosse's musk shrews live only in forest habitats, either in the rainforest zone or in relic forests in derived savanna. Although they were rarely obtained in surveys in western Nigeria (Happold 1975), they are probably the commonest shrew in Nigerian rainforests. During a three year study in Gambari Forest Reserve, only two species of shrew were found: 40 (70 %) were this species and 16 were large shrews of the *poensis/nigeriae* group (Happold 1977). Crosse's musk shrews are terrestrial but they can clamber over fallen decaying branches and tree trunks. They search for invertebrate food under the leaf litter, in crevices in the soil and in rotten wood. It is possible that this species searches for food over quite a large area (2 ha), only four were seen a second time; of these, three were seen again within a month and the fourth was found five months after first capture. This suggests that most individuals do not remain in the same area for very long.

Pregnant females have been recorded in the wet season (April, May, October and November) but it is not known whether they also breed during the dry season; litter size is 2-4.

**T a x o n o m y :** *Crocidura crossei* lives in rainforest and in derived savanna habitats. Specimens living in rainforest are usually darker than those living in savannas. But there is also a considerable variation in colour and the degree of darkness of the pelage from one locality to another within the same vegetation zone. Size and shape of the skull vary little and are always characteristics which serve to identify the species. Several names are presently regarded as synonyms or subspecies of *crossei*: *ingoldbyi*, *jouvenetae* and *ebriensis* (Heim de Balsac & Meester 1977). In Ivory Coast, there is a di-



Map 6: Distribution of *Crocidura douceti* and *C. crossei* in Nigeria.

stinctly larger taxon (*ebriensis*) which may represent a separate species. The karyotype listed in Table 1 was taken from an Ivory Coast specimen (Meylan & Vogel 1982).

**Specimens examined (37):**

Asaba, BMNH 95.5.3.4 (holotype); Ashaka, USNM 377059, 377060; Gambari F. R., DH 889, 1059-1061, 1098, 1156, 1187, 1189, 1191, 1192, 1256, 1297, 1670, 1673, 1750, 72.23, 72.27, 72.41, 72.59, 72.61; Ibadan, USNM 402237-8; Ilashe, 4 miles south, USNM 402239-402241; Kabba, DH 1553; Karaduwa, USNM 402242; Kudu, USNM 402289; Oke-Iho, DH 839; Omu-Aran, DH 1602; Shasha F. R., DH 1376-7, 1399; Upper Ogun ranch, USNM 402253.

***Crocidura* cf. *gracilipes* Peters**

Fig. 17

*Crocidura* (*Cr.*) *gracilipes* Peters, 1870: 590; Kilimanjaro, Tanzania.

**Diagnosis:** Small to medium-sized shrews. Dorsal and ventral surfaces dark brown. Tail with bristles on terminal 60 % of its length. Skull (Fig. 17) smaller than in

any other dark brown shrew. Braincase rounded in dorsal view, slightly domed in lateral view. Dentition weak, third upper molar not reduced.

**Measurements:** A single female from Okpuje: HB 76, T 54, HF 13, WT 6.7, CI 19.9, IW 4.3, MB 6.4, GW 9.0, HCC 5.2, UTR 8.4.

**Distribution:** Only one record from Nigeria (Meylan & Vogel 1982).

**Natural history:** The female contained three embryos. It was found in cultivated farmland in the derived savanna of eastern Nigeria.

**Taxonomy:** *Crocidura gracilipes*, as understood by Heim de Balsac & Meester (1977), is a species which includes many named forms occurring from South Africa to Cameroun. There are also a few uncertain records from Guinea and Portuguese Guinea (Heim de Balsac 1968 a). The new specimen from Nigeria is similar in size to specimens from Cameroun, but differs slightly in having a domed braincase and a more pointed rostrum, thus resembling the long-tailed shrew, *Crocidura dolichura*. The karyotype of the Nigerian specimen was described by Meylan & Vogel (1982) and this should be carefully compared with the karyotypes of East African specimens. It is possible that the Nigerian form belongs to *Crocidura gracilipes virgata* Sanderson, 1940 which was described from Tinta, Cameroun near the border to Nigeria.

**Specimen examined (1):**

Okpuje, AM 1644.

### Long-Tailed Shrew

#### *Crocidura dolichura* Peters

Fig. 18, Map 7

*Crocidura (Croc.) dolichura* Peters, 1876: 475; Bonjongo, Cameroun.

**Diagnosis:** Tail markedly longer than head and body, about 125 % of HB; tail almost naked. Dorsal pelage deep grey tinted with chocolate-brown; ventral pelage grey. Limbs pale. Skull (Fig. 18) small with a short rostrum, narrow maxillary region and a rounded and highly domed braincase. Teeth very small.

**Measurements:** Two adult males: HB 70, 60, T 73, 75, HF 13, 12, E 10, 9, WT 6, 5, CI 18.8, 19.5, IW 4.1, 3.8, MB 5.6, 5.7, GW 8.1, 8.4, HCC 4.7, 4.7, UTR 7.9, 8.3.

**Distribution:** Very localised in rainforest zone; here recorded for the first time from Nigeria. For a summary of distributional records, see Hutterer (1981 b).

**Natural history:** No first-hand information. These shrews have very long tails and probably use their long tail as an aid to balancing. They probably occur throughout the rainforest zone in natural forest habitats.

**Taxonomy:** Two subspecies have been recorded from West Africa: *dolichura* from Cameroun, Central African Republic, and Zaire, and *muricauda* from Liberia to Ghana (Heim de Balsac & Meester 1977). The Nigerian specimens clearly belong to *dolichura*, as they have completely naked tails. *Crocidura dolichura muricauda* has scattered, sometimes numerous, long bristles along the tail. The taxonomic position of this form is not yet clear; it may even represent a separate species.

**Specimens examined (3):**

Calabar, 15 miles north, USNM 377058; Gambari F. R., DH 1255; Sapoba F. R., USNM 377057.



Map 7: Distribution of *Crocidura bottegi* and *C. dolichura* in Nigeria.



## Small Forest Shrew

### *Crocidura bottegi* Thomas

Fig. 19, Map 7

*Crocidura (Cr.) bottegi* Thomas, 1898: 677; between Badditù and Dimè, Ethiopia.

**D i a g n o s i s :** A very small shrew. Dorsal surface rich chocolate-brown with russet tinge. Ventral surface slightly paler. Limbs with brown hairs. Ears dark brown. Tail short, about 70 % of HB, with few long bristles. Skull (Fig. 19) with a high, rounded braincase and short interorbital and maxillary region. Dentition weak but third upper molar rather heavy.

**M e a s u r e m e n t s :** Three adults (two males, one female) from Gambari and Shasha: HB 45-50, T 30-35, HF 10, E 6-8, WT 2.5-4, CI 15.6-15.9, IW 3.5-3.8, MB 4.8-5.1, GW 7.1-7.3, HCC 4.0-4.3, UTR 6.7-6.9.

**D i s t r i b u t i o n :** The species is here recorded for the first time from Nigeria, although its occurrence was expected. It is known from Sierra Leone (Heim de Balsac 1971) in the west to Ethiopia in the east (Heim de Balsac & Meester 1977).

**N a t u r a l h i s t o r y :** These very small shrews have only been found in rainforest habitats where they appear to be uncommon and localised. Two records from owl pellets collected in Guinea savanna might indicate that the species lives also in forest relics within the savannas, but these records are somewhat uncertain, due to the fragmentary character of the material.

**T a x o n o m y :** Three complete specimens from Shasha and Gambari agree well with the holotype of the species. However, there are several skulls from owl pellets collected at Yankari Game Reserve which deviate somewhat in size, particularly in the maxillary breadth and the upper tooththrow length. Heim de Balsac (1958) described a subspecies (*obscurior*) from Mt. Nimba, Guinea, which is characterized by its larger size; on the other hand, he described another subspecies (*eburnae*) from southern Ivory Coast, which is very near to typical *bottegi* from Ethiopia. The name *obscurior* indicates that he himself was uncertain about the status of the larger form. The fragmentary material reported upon here is also insufficient to solve the problem of whether there are two subspecies or species of „*bottegi*” in West Africa. Further collecting in Yankari Game Reserve should bear this problem in mind.

**S p e c i m e n s e x a m i n e d (49):**

Futuk, AD 46, 49, 58, 119; Gambari F. R., DH 1257; Shasha F. R., DH 1373, 1380; Toro, RNHL 30983; Wikki, AD 65, 66, 69-78, 80-90, 92-96, 106, 109, 114, 115, 121; Zaria, HNHM 78.10.1-2, 78.10.4-8, 78.10.10.

### Small Savanna Shrews

#### *Crocidura yankariensis* Hutterer & Jenkins

Figs. 20, 28

*Crocidura yankariensis* Hutterer & Jenkins, 1980: 305; Futuk, 16 km east of the Yankari Game Reserve boundary, Nigeria.

**D i a g n o s i s:** Small shrews. Dorsal pelage olive-brown; ventral pelage light greyish-olive, not clearly delineated from dorsal pelage. Hairs short, 2—3 mm, grey at



Fig. 28: *Crocidura yankariensis*, specimen preserved in alcohol from Sudan (BMNH 55.618). Note the large ears and the naked tibia. Head and body length of the specimen: 60 mm.

base. Muzzle with fine short brownish hairs, and vibrissae up to 22 mm in length. Ears large with short brownish hairs. Lower part of hindlimbs easily visible due to absence of body hairs (Fig. 28), a very distinctive external character of this species. Hands and feet covered with fine whitish hairs; hindfeet only slightly longer than ears; toes of hindfeet short. Tail short, thick at base; brown on dorsal surface, white on undersurface; densely covered with long bristles; about 67 % of HB (description partly taken from Hutterer & Jenkins 1983). Skull (Fig. 20) flat and broad. Superior articular facet of braincase with a well developed angular crest. Interorbital constriction long and narrow. Zygomatic process well developed. Dentition very characteristic: fourth upper premolar very robust particularly the large metacone; proto- and metaconid of the first lower molar united, nearly forming a joint cusp; third lower molar minute.

**Measurements:** The type series from Yankari Game Reserve: IW 3.8-4.4, MB 5.5-6.1, GW 8.0-8.4, UTR 7.7-8.4. External measurements of East African specimens: HB 52-60, T 35-41, HF 9.5-10.1, E 6-7.5, WT  $\pm$  5; for further measurements see Hutterer & Jenkins (1980, 1983).

**Distribution:** The species was described on the basis of skulls from owl pellets collected by A. Demeter at Futuk and Wikki, Yankari G. R.; no other specimens have been found since then in Nigeria, but Hutterer & Jenkins (1983) recorded further specimens from Sudan, Ethiopia, Kenya and Somalia.

**Natural history:** Remains of thirteen *Crocidura yankariensis* were found in owl pellets of *Tyto alba* and *Bubo africanus* at Yankari Game Reserve, indicating that the species is not very rare. Other mammals living in the same place were listed by Demeter (1981); for a general description of the reserve see Sikes (1964), Geerling (1973) and Henshaw (1975).

**Specimens examined (13):**

Futuk, HNHN 80.1.1 (holotype), AD 30, 33, 36, 44, 47, 51, 54, BMNH 81.3, ZFMK 80.805; Wikki, AD 67, 99, 100.

### *Crocidura douceti* Heim de Balsac

Fig. 21, Map 6

*Crocidura douceti* Heim de Balsac, 1958: 329; Adiopodoumé, Ivory Coast.

**Diagnosis:** Very small shrews. Dorsal pelage greyish-brown to chocolate-brown; ventral surface grey. Dorsal pelage paler in northern populations. Hairs uniformly coloured. Fore and hind limbs with pale hairs. Tail dark and thin, with small hairs and dark bristles; about 81 % of HB. Skull (Fig. 21) a smaller version of that of *Crocidura crossei*, with a shorter rostrum. Dorsal line of skull with a mid-dorsal angle.

**Measurements:** Five specimens from Abuja: HB 50-55, T 40-45, HF 10, E 8, WT 4-5, CI 16.4-17.3, IW 3.6-4.0, MB 4.9-5.4, GW 7.0-7.5, HCC 3.8-4.2, UTR 6.8-7.5.

**Distribution:** These are the first records of *Crocidura douceti* from Nigeria, where the species is localised in Guinea savanna zone.

**Natural history:** These very small shrews live in relic forests in Guinea savanna. They have rarely been found due to their small size, but they may be more widespread and common in relic and riverine forests than the locality records suggest. Heim de Balsac & Vuattoux (1969) reported on a nest containing two juveniles which was situated in a cavity in a palm tree fifteen meters above the ground.

**Taxonomy:** We observed some colour variation in this species; five specimens from Abuja are dark-brown dorsally (similar to *bottegi*), two specimens from Panyam and Ugar Jabar are paler and have a tail more densely covered with whitish bristles. This kind of colour variation is similar to the one observed in *Crocidura crossi*, a species also occurring in forest and savanna habitats. — *Crocidura douceti* was known before only by few specimens collected in Guinea and Ivory Coast (Heim de Balsac & Vuattoux 1969). No other specimens have been recorded since then.

#### Specimens examined (20):

Abuja, DH 1168-9, 1173, 1179, 1180; Futuk, AD 45, 37, 56, 59, 62; Panyam Fish Farm, USNM 402291; Ugar Jabar, USNM 402290; Wikki, AD 79, 64, 68, 105, 110, 111, 112, 113.

### *Crocidura fuscomurina* Heuglin

Fig. 22, Map 8

*S. fusco murinus* Heuglin, 1865: 36; Meshra-el-Req, Sudan.

**Diagnosis:** Very small shrews. Dorsal pelage greyish-brown to pale brown; hairs grey with pale brown tips. Ventral pelage greyish-white; hairs grey with whitish tips. Limbs pale, with small white hairs. Tail long and thin, with many short bristles and scattered long hairs; about 97 % of HB. Skull (Fig. 22) small with a slender rostrum; similar to *Crocidura planiceps*, but slightly larger and more robust.

**Measurements:** A single male from New Bussa: HB 43, T 42, HF 10, E 6, WT 3, CI 18.0, IW 3.8, MB 5.4, GW 7.8, HCC 4.2, UTR 7.4.

**Distribution:** Known only from three localities in the Guinea savanna zone. The species itself is widespread in the savannas of Africa (Hutterer 1983c).

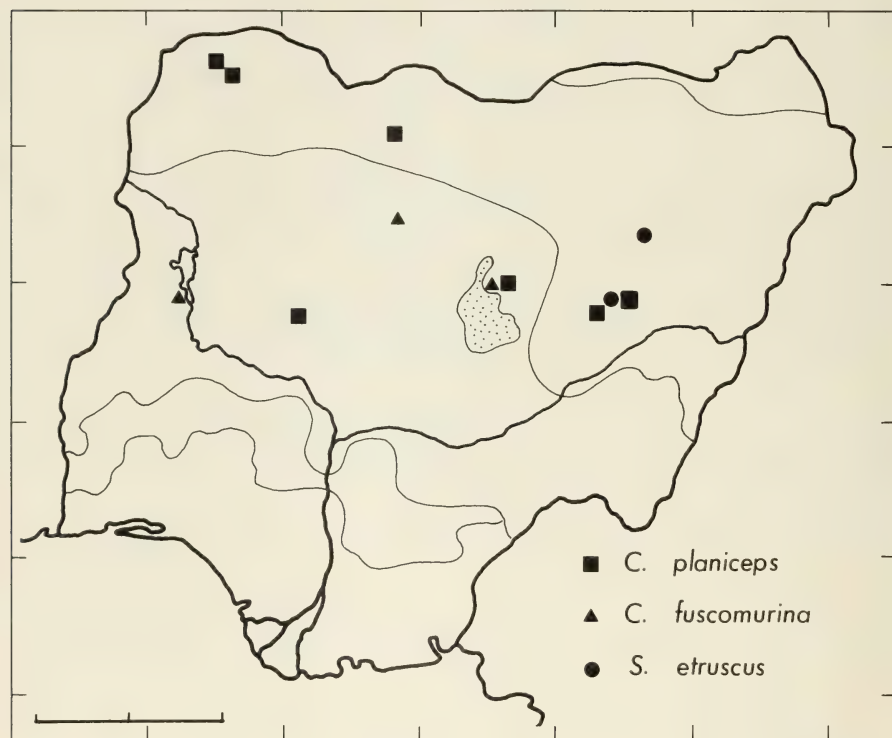
**Natural history:** These small shrews live in sheltered habitats in savanna grasslands. Their remains have been found in owl pellets from Toro and Zaria.



**Taxonomy:** *Crocidura fuscomurina* is the valid name for the species previously called *C. bicolor*. For a discussion of its taxonomy, synonymy and distribution, see Hutterer (1983c).

**Specimens examined (4):**

New Bussa, DH 1327; Toro, RNHL 30985; Zaria, HNHM 78.10.3, 78.10.9.



Map 8: Distribution of *Crocidura planiceps*, *C. fuscomurina* and *Suncus etruscus* in Nigeria.

### *Crocidura planiceps* Heller

Fig. 23, Map 8

*Crocidura planiceps* Heller, 1910: 5; Rhino Camp, Uganda. — ? *Crocidura glebula* Dollman, 1915: 517; 1916: 196; Zungeru, Nigeria.

**Diagnosis:** Very small shrews, similar to *Crocidura fuscomurina*. Dorsal surface cinnamon-brown to greyish-brown. Ventral surfaces paler tending to yellowish-grey or silvery-grey. Limbs pale. Tail shorter than HB, with long bristles covering 70–80 % of



its length. Skull smaller and slimmer than that of *Crocidura fuscomurina* particularly for the maxillary region and the braincase. UTR shorter than in *C. fuscomurina*.

**Measurements:** Four adult specimens from northern Nigeria: HB 50-66, T 39-48, HF 9-11, E 6-8, WT 2-3, CI 16.4-17.1, IW 3.3-3.8, MB 4.5-5.0, GW 6.5-7.4, HCC 3.5-3.7, UTR 6.5-7.1.

**Distribution:** Sudan and Guinea savanna zones (Map 8). Here recorded for the first time from Nigeria.

**Natural history:** The specimens from Yankari Game Reserve were caught in *Cyperus* swamp near a stream, and their bony remains have been found in owl pellets from that region. The specimen from Zungeru (holotype of *glebula*) was found in the mudnest of white ants, but whether this is the normal domicile of these shrews is not known. Eight specimens collected near Sokoto from 27 to 30 November 1966 included three nestlings weighing one gram each, two juveniles, one young adult, and two adults (collector's notes).

**Taxonomy:** The species *Crocidura planiceps*, as understood here, shows some variation within Nigeria. Two specimens from Yankari G. R. (incorrectly assigned to *C. pasha* by Hutterer, in Demeter 1981) are much darker than specimens from Sokoto, and the skulls of individuals from the two populations differ slightly in size. More material is necessary to clarify this situation. The series from Sokoto shows the same characters as does the holotype of *Crocidura planiceps* from Uganda (figured by Hollister 1918), and is certainly correctly assigned to this species.

The type and only known specimen of *Crocidura glebula* consists of a faded skin without skull. With this insufficient type material the species is not really identifiable. In its pale dorsal surface and its external measurements it resembles specimens of *C. planiceps* from northern Nigeria and is therefore at best assigned to this species.

The relationship between *Crocidura fuscomurina* and *Crocidura planiceps* remains to be studied. Both are very similar, and not all specimens can be easily identified to species. At Toro, both species seem to coexist, what would support the view taken here. Another possible view is that *C. planiceps* is a smaller ecological variant of *Crocidura fuscomurina*.

#### Specimens examined (18):

Futuk, AD 48, 50, 53; Kware, fourteen miles north Sokoto, USNM 402255-402262; Karaduwa, USNM 402245; Tangaza, USNM 402263; Toro, RNHL 30984; Yashi River, Yankari G. R., HNHN 4453-4; Zungeru, BMNH 4.7.9.14 (holotype of *glebula*).

*Crocidura lusitania* Dollman

Fig. 24

*Crocidura lusitania* Dollman, 1915: 516; 1916: 198; Trarza country, Mauritania.

**D i a g n o s i s :** Tiny prettily-coloured shrews. Dorsal surface greyish-brown, ventral surface pure white. White patches on chin, feet and behind each ear. Tail densely covered with long hairs, white on undersurface. This species is the only shrew in Nigeria with a pure white ventral surface. Skull (Fig. 24) very flat and very small. Braincase and maxillary region broad, interorbital constriction narrow. Third upper molar very small.

**M e a s u r e m e n t s :** A single female from Kware: HB 62, T 38, HF 10, E 8, WT 2, CI 15.7, IW 3.4, MB 4.9, GW 7.1, HCC 3.5, UTR 6.6.

**D i s t r i b u t i o n :** This is the first record of *Crocidura lusitania* from Nigeria. The species is known from Sudan and Sahel savanna in Mauritania, Senegal and Morocco (Heim de Balsac & Meester 1977), but obviously has a much wider distribution.

**N a t u r a l h i s t o r y :** No information.

**T a x o n o m y :** The Kware specimen is slightly smaller than specimens from Mauritania and Senegal but agrees with them in coloration and all essential skull characters. No subspecies have been described.

**S p e c i m e n e x a m i n e d (1):**

Kware, fourteen miles north Sokoto, USNM 402254.

## DISCUSSION

Of the twenty-four species of shrews now known to occur in Nigeria, two species, *Crocidura foxi* and *Crocidura longipes*, have not yet been recorded from other countries. All the other species are known to occur in other African countries as well as Nigeria. It is more than likely that a number of additional species will be found to live in Nigeria, especially along the Cameroun border and on the Obudu plateau in the south-east of the country. From its floristic composition, the Obudu plateau is a series of 'ecological islands' (Hall 1981) which may support endemic species or subspecies of shrews; alternatively, the shrews may be the same as those of the Cameroun mountains system whose fauna is well documented (Eisentraut 1963, 1973). Recent studies on the shrews of Cameroun (Heim de Balsac 1968 b, Hutterer & Joger 1982) suggest that the following species may be expected in the mountainous regions just west of the Cameroun-Nigeria border: *Myosorex eisentrauti*, *Sylvisorex granti*, *Sylvisorex johnstoni*, *Sylvisorex morio*, *Sylvisorex ollula*, *Suncus infinitesimus*, *Paracrocidura schoutedeni*, *Crocidura attila*, *Crocidura boydi*, *Crocidura denti*, *Crocidura manengubae*, *Crocidura roosevelti* and *Crocidura turba*. *Crocidura picea*, a doubtful species (see Heim de Balsac & Hutterer 1982) may occur in the rainforest zone, and there may be further species which are widespread in the Sudan and Sahel savanna zones of West Africa but which have not yet been recorded from localities close to the Nigerian border. If the expected species are included, there would be a minimum of 38 species of shrews in Nigeria. This would be by far the largest number known from any African country; however, as shrews have rarely been studied in great detail in individual countries, this species richness may be quite normal. Valid comparisons must await further studies.

We have tried to classify the species ecologically as belonging to particular vegetation zones (Table 2). Our classification is tentative as so little ecological information is available for most of these shrews. Some species live in several habitats in both rainforest and savanna, and are therefore difficult to classify.

We regard our work as a first step towards a knowledge of the shrew fauna of Nigeria. Many taxonomic problems are left in doubt due to lack of adequate material. Future research should concentrate on the study of chromosomes, particularly of the species in the *Crocidura poensis* complex. The status of *Crocidura bottegi* is worth studying, particularly in Yankari Game Reserve where two forms seem to occur in considerable numbers. Other problems are the status of *Crocidura foxi* in relation to *Crocidura theresae* in Ivory Coast, and the relationships of *Crocidura planiceps* to *Crocidura fuscomurina*. We also hope that this paper will facilitate future ecological studies on the many species living in Nigeria.

## SUMMARY

A revision of the species of shrews (Soricidae) occurring in Nigeria is presented. Twenty-four species are definitely recognised as occurring within the boundaries of the country, and fourteen other species are known from nearby areas and may cross its borders. Three genera, *Sylvisorex*, *Suncus* and *Crocidura*, are represented, and two others are likely to occur in the mountains of south-eastern Nigeria. Keys to external characters and to skulls are provided for all species occurring in Nigeria, and illustrations of skull characters are given for all species. For each species, a diagnosis, measurements, notes on distribution, natural history, taxonomy, and specimen records are provided. Some taxonomic problems are discussed, but the final resolution of most of them requires more material, from Nigeria and also from other countries. A new species, *Crocidura longipes*, is described. Most species are grouped according to one of the main vegetation zones (rainforest, derived savanna, Guinea, Sudan or Sahel savanna), although many more ecological data are required before final conclusions can be drawn. Some proposals for future work are made.

## ZUSAMMENFASSUNG

Es wird eine Revision der in Nigeria vorkommenden Spitzmäuse (Soricidae) vorgelegt. Vierundzwanzig Arten werden als eindeutig im Land vorkommend nachgewiesen, vierzehn weitere Arten sind aus benachbarten Regionen bekannt und mögen ebenfalls im Land vorkommen. Drei Gattungen sind vertreten, *Sylvisorex*, *Suncus* und *Crocidura*, zwei weitere kommen wahrscheinlich in den Berggebieten Südost-Nigerias vor. Bestimmungsschlüssel zu allen Arten und Illustrationen ihrer Schädelmerkmale sind ebenso enthalten wie eine kurze Diagnose, Maße, Bemerkungen zur Verbreitung, Naturgeschichte, Taxonomie, sowie Fundortverzeichnisse für jede Art. Einige taxonomische Probleme werden diskutiert; aber deren Lösung erfordert in den meisten Fällen zusätzliches Material, auch aus anderen Ländern. Als neue Art wird *Crocidura longipes* beschrieben. Die meisten Arten werden in Verbindung mit einer der Vegetationszonen (Regenwald, Übergangssavanne, Guinea-, Sudan- oder Sahelsavanne) gruppiert, auch wenn für eine endgültige Einordnung der Arten noch weitaus umfangreicheres ökologisches Datenmaterial erforderlich ist. Einige Vorschläge für künftige Arbeiten werden gemacht.



## Gazetteer

Abuja	9.10 N	7.11 E	Kware	13.13 N	5.16 E
Abutshi, see Onitsha			Lagos	6.27 N	3.23 E
Afon	8.19 N	4.32 E	Lake Chad	13.20 N	14.00 E
Agberi	5.14 N	6.24 E	Lokoja	7.48 N	6.44 E
Aguleri	6.20 N	6.53 E	Maiduguri	11.51 N	13.09 E
Akpaka FR	6.15 N	6.47 E	Mamu River FR	6.10 N	7.10 E
Aponmo FR	7.19 N	5.02 E	Nde	6.03 N	8.39 E
Asaba	6.11 N	6.45 E	New Bussa	9.53 N	4.31 E
Ashaka	5.38 N	6.24 E	Nko	5.52 N	8.11 E
Awka	6.13 N	7.05 E	Nsukku	6.52 N	7.23 E
Ayangba	7.07 N	7.28 E	Oban	5.19 N	8.34 E
Azare	11.41 N	10.12 E	Oke-Iho	8.02 N	3.21 E
Bahindi	11.28 N	4.11 E	Okpo	7.11 N	7.34 E
Baiku	7.28 N	8.35 E	Okpuje	6.50 N	7.20 E
Bauchi	10.19 N	9.50 E	Olle FR	8.05 N	6.07 E
Benin	6.20 N	5.38 E	Omu-Aran	8.08 N	5.06 E
Bida	9.05 N	6.01 E	Onitsha	6.10 N	6.47 E
Calabar	4.57 N	8.19 E	Oron	4.46 N	8.13 E
Dada	11.34 N	4.29 E	Osa	5.11 N	7.26 E
Dikwa	12.02 N	13.55 E	Owerri	5.29 N	7.02 E
Fanisau	12.05 N	8.32 E	Oyakama, see Port Harcourt		
Farniso, see Fanisau			Oyo	7.51 N	3.56 E
Fika	11.17 N	11.18 E	Pandam GR	8.40 N	9.00 E
Filele	7.51 N	6.43 E	Panisau, see Fanisau		
Futuk	9.50 N	10.55 E	Pankshin	9.16 N	9.30 E
Gambari FR	7.08 N	3.50 E	Panyam	9.25 N	9.13 E
Ibadan	7.23 N	3.54 E	Port Harcourt	4.43 N	7.10 E
Ibi	8.11 N	9.45 E	Sapoba FR	6.06 N	5.53 E
Igbo-Oloyin	7.33 N	3.58 E	Shasha FR	7.05 N	4.20 E
Igbo-Ora	7.26 N	3.17 E	Sherifuri	10.51 N	11.24 E
Ikom	5.58 N	8.42 E	Tangaza	13.22 N	4.56 E
Ilashe	7.30 N	6.30 E	Toro	10.03 N	9.04 E
Jemaa	9.28 N	8.23 E	Ugar Jabar	9.31 N	8.23 E
Jos	9.55 N	8.54 E	Umuahia	5.32 N	7.29 E
Kabba	7.50 N	6.04 E	Upper Ogun ranch	8.10 N	3.41 E
Kabwir	9.24 N	9.34 E	Wikki	9.45 N	10.30 E
Kano	12.00 N	8.31 E	Yankari GR	9.45 N	10.30 E
Karaduwa	12.19 N	7.41 E	Zaria	11.04 N	7.42 E
Katsina	13.00 N	7.36 E	Zonkwa	9.47 N	8.17 E
Kudu	9.16 N	5.21 E	Zungeru	9.48 N	6.09 E

## LITERATURE CITED

- Allen, G. M. & A. Loveridge (1933): Reports on the scientific results of an expedition to the southwestern highlands of Tanganyika Territory. II. Mammals. — Bull. Mus. comp. Zool. Harv. 75: 47—140.
- Amadon, D. (1966): The superspecies concept. — Syst. Zool. 15: 245—249.
- Bates, G. L. (1927): Notes on some birds of Cameroon and the Lake Chad Region: their status and breeding times. — Ibis 3 (12): 1—64.
- Churchfield, S. (1982): A note on the diet of the African musk shrew. — Acta theriol. 27: 347—360.
- Cozens, A. B. & S. Marchant (1952): A contribution to the fauna of Owerri Province. Part I. — Niger. Fld. 17: 70—79.
- Demeter, A. (1978): Food of a Barn Owl *Tyto alba* in Nigeria. — Bull. Nigerian Orn. Soc. 14: 9—13.
- (1981): Small mammals and the food of owls (*Tyto* and *Bubo*) in northern Nigeria. — Vertebr. hung. 20: 127—136.
- Dietler, F. (1967): Eine neue Methode für Lebendfang, Populationsstudien und Dichtebestimmung an Kleinsäugetern. — Acta Tropica 24: 244—260.
- & H. Heim de Balsac (1979): Zur Ökologie und Taxonomie der Spitzmäuse (Soricidae) des Kivu-Gebietes. — Säugetierkd. Mitt. 27: 241—287.
- Dollman, G. (1915-16): On the African shrews belonging to the genus *Crocidura*. — Ann. Mag. nat. Hist. (8) 15: 507—527; (8) 16: 124—146, 506—514; (8) 17: 188—209.
- Eisenrath, M. (1963): Die Wirbeltiere des Kamerungebirges. 353 pp. — Hamburg & Berlin.
- (1973): Die Wirbeltierfauna von Fernando Poo und Westkamerun. — Bonn. zool. Monogr. 3, 428 pp. + pl. 1—5.
- Fraser, L. (1843): Exhibition of a specimen of the *Galago Senegalensis*, procured at Cape Coast, Western Africa, and a new species of shrew from Fernando Po. — Proc. zool. Soc., Lond. 10 (1842): 200—201.
- Geerling, C. (1973): The vegetation of Yankari Game Reserve, its utilisation and condition. — Dept. For., Univ. Ibadan, Bull. 3: 1—49.
- Geoffroy Saint-Hilaire, I. (1834): Mammifères, p. 1—160. — In: Belanger, C. — Voyage aux Indes-Orientales, par le nord de l'Europe, . . . pendant les années 1825, 1827, 1828 et 1829. — xxxix + 535 pp., Paris (A. Bertrand).
- Hall, J. B. (1981): Ecological islands in south-eastern Nigeria. — Afr. J. Ecol. 19: 55—72.
- Hapold, D. C. D. (1975): The effects of climate and vegetation on the distribution of small rodents in Western Nigeria. — Z. Säugetierk. 40: 221—242.
- (1977): A population study on small rodents in the tropical rainforest of Nigeria. — Terre et Vie 31: 387—458.
- (in press): Geographical ecology of Nigerian mammals. — Ann. koninkl. Mus. Midden-Afr.; Abstract in: Afr. Small Mammal Newsl., s.n. 4: 38, 1981.
- Heim de Balsac, H. (1958): La Reserve Intégrale du Mont Nimba. 14. Mammifères Insectivores. — Mém. Inst. fr. Afr. noire 53: 301—337, 3pls.
- (1968 a): Recherches sur la faune des Soricidae de l'ouest Africain (du Ghana au Sénégal). — Mammalia 32: 379—418.
- (1968 b): Contribution à l'étude des Soricidae de Fernando Po et du Cameroun. — Bonn. zool. Beitr. 19: 15—42.
- (1971): Le massif des Monts Loma (Sierra Leone). XX. Mammifères Muridae et Soricidae. — Mém. Inst. fr. Afr. noire 86: 409—417.
- & W. Allen (1958): Les Soricidae de basse Côte-d'Ivoire. — Revue suisse zool. 65: 921—956.

- & J.-J. Barloy (1966): Revision des Crocidures du groupe *flavescens-occidentalis-manni*. — *Mammalia* 30: 601—633.
- & R. Hutterer (1982): Les Soricidae (Mammifères Insectivores) des île du Golfe de Guinée: faits nouveaux et problèmes biogéographiques. — *Bonn. zool. Beitr.* 33: 133—150.
- & J. Meester (1977): Order Insectivora. — In: Meester, J. & H. W. Setzer (eds): *The mammals of Africa. An identification manual*. 1: 1—29. — Washington.
- & R. Vuattoux (1969): *Crociodura douceti* H. de B. et le comportement arboricole des Soricidae. — *Mammalia* 33: 98—101.
- Heller, E. (1910): New species of insectivores from British East Africa, Uganda, and the Sudan. — *Smithson. misc. Collns* 56 (15): 1—8.
- Henshaw, J. (1975): The ecology and management of Yankari Game Reserve. — F.A.O. Rome, FO: DP/NIR/72/002, Techn.Rep., 106 pp.
- Heuglin, T. von (1865): Weitere Einsendungen an die Kaiserl. Leopold.-Carol. deutsche Akademie der Wissenschaften, mit zoologischen Notizen aus Afrika. — *Nova Acta Acad. Caesar. Leop. Carol.* 32: 32—36.
- Hollister, N. (1918): East African mammals in the United States National Museum. — *Bull. U. S. nat. Mus.* 99: 1—194.
- Honacki, J. H., K. E. Kinman & J. W. Koeppl (1982): Mammal species of the world. 1—694. — Lawrence.
- Hutterer, R. (1981 a): Range extension of *Crociodura smithii*, with description of a new subspecies from Senegal. — *Mammalia* 45: 388—391.
- (1981 b): Nachweis der Spitzmaus *Crociodura roosevelti* für Tanzania. — *Stuttgart. Beitr. Naturkde. Ser.A, Nr.* 342: 1—9.
- (1983 a): *Crociodura grandiceps*, eine neue Spitzmaus aus Westafrika. — *Revue suisse zool.* in press.
- (1983 b): Status of some African *Crociodura* described by Isidore Geoffroy Saint-Hilaire, Carl J. Sundevall and Theodor von Heuglin. — *Ann. koninkl. Mus. Midden-Afr.* in press; Abstract in: *Afr. Small Mammal Newsl.*, s.n. 4: 3, 1981.
- (1983 c): Taxonomy and distribution of *Crociodura fuscomurina* (Heuglin, 1865). — *Mammalia* 47,2.
- & P. D. Jenkins (1980): A new species of *Crociodura* from Nigeria (Mammalia: Insectivora). — *Bull. Br. Mus. nat. Hist. (Zool.)* 39: 305—310.
- & — (1983): Species-limits of *Crociodura somalica* Thomas, 1895 and *Crociodura yankariensis* Hutterer & Jenkins, 1980 (Insectivora: Soricidae). — *Z. Säugetierk.* 48: in press.
- & U. Jöger (1982): Kleinsäuger aus dem Hochland von Adamaoua, Kamerun. — *Bonn. zool. Beitr.* 33: 119—132.
- & D. Kock (1983): Spitzmäuse aus den Nuba-Bergen Kordofans, Sudan (Mammalia: Soricidae). — *Senckenbergiana biol.* 63: 17—26.
- & P. Vogel (1977): Abwehrlaute afrikanischer Spitzmäuse der Gattung *Crociodura* Wagler, 1832 und ihre systematische Bedeutung. — *Bonn. zool. Beitr.* 28: 218—227.
- Jentink, F. A. (1888): Zoological researches in Liberia. A list of mammals, collected by J. Büttikofer, C. F. Sala and F. X. Stampfli, with biological observations. — *Notes Leyden Mus.* 10: 1—58.
- Leconte, J. (1857): Descriptions of several new mammals from Western Africa. — *Proc. Acad. nat. Sci. Philadelphia* 1857: 10—11.
- Meester, J. (1963): A systematic revision of the shrew genus *Crociodura* in Southern Africa. — *Transvaal Mus. Mem.* (13): 1—127.
- & A. V. W. Lambrechts (1971): The Southern African species of *Suncus* Ehrenberg (Mammalia: Soricidae). — *Ann. Transv. Mus.* 27: 1—14.
- Meylan, A. (1968): Note sur les chromosomes de la musaraigne étrusque *Suncus etruscus* (Savi). — *Bull. Soc. vaud. Sci. nat.* 70: 85—90.
- (1975): Formule chromosomique de *Sylvisorex megalura* (Jentink) (Mammalia, Insectivora). — *Mammalia* 39: 319.

- & P. Vogel (1982): Contribution à la cytotaxonomie des Soricidés (Mammalia, Insectivora) de l'Afrique occidentale. — *Cytogenet. Cell. Genet.* 34: 83—92.
- Morrison-Scott, T. C. S. (1946): *Suncus etruscus* (Savi) in Africa. — *Mammalia* 10: 145.
- Murray, A. (1860): Contributions to the fauna of Old Calabar — mammals. — *Proc. Roy. Phys. Soc. Edinburgh* 2: 156—159.
- Peters, W. (1870): Über neue Arten von Spitzmäusen des Königl. zoologischen Museums aus Ceylon, Malacca, Borneo, China, Luzon und Ostafrika. — *Monatsb. K. Preuss. Akad. Wiss.* Berlin 1870: 584—596.
- (1876): Über die von dem verstorbenen Professor Dr. Reinhold Buchholz in Westafrika gesammelten Säugetiere. — *Monatsb. K. Preuss. Akad. Wiss.*, Berlin 1876: 469—485.
- (1878): Mittheilung über eine neue Spitzmaus aus Westafrika. — *Sber. Ges. naturf. Freunde Berl.* 1878: 19—20.
- Petter, F. & A. Chippaux (1962): Description d'une musaraigne pygmée d'Afrique équatoriale *Suncus infinitesimus ubanguiensis* subsp. nov. — *Mammalia* 26: 512—516.
- Ridgway, R. (1912): Color standards and color nomenclature. 43 pp., 53 pls. — Washington.
- Rosevear, D. R. (1941): The Insect Eaters of Nigeria. — *Niger. Fld.* 10: 98—103.
- (1953): Checklist and atlas of Nigerian mammals. — Lagos.
- Sanderson, I. T. (1940): The mammals of the north Cameroons forest area. — *Trans. zool. Soc. Lond.* 24: 623—725, 22 pls.
- Savi, P. (1822): Osservazioni sopra il Mustietto, o Mustiolo, nuova specie di Topo ragno Toscano. — *Nuovo Giornale de Letterati*, Pisa, 1: 60—71, 1 pl.
- Sikes, S. (1964): A game survey of the Yankari reserve of Northern Nigeria. — *Niger. Fld.* 29: 54—82.
- Sundevall, C. J. (1843): Om släktet *Sorex*, med några nya arters beskrifning. — *K. svenska Vetensk-Akad. Handl.* 1842: 163—188.
- Thomas, M. R. O. (1895): Descriptions of five new African shrews. — *Ann. Mag. nat. Hist.* (6) 16: 51—55.
- (1898): On the mammals collected during Captain Bottego's last expedition to Lake Rudolf and the upper Sobat. — *Ann. Mus. civ. Stor. nat. Giacomo Doria* 18: 676—679.
- (1911): New African mammals. — *Ann. Mag. nat. Hist.* (8) 8: 375—378.
- Vogel, P. (1974): Note sur le comportement arboricole de *Sylvisorex megalura* (Soricidae, Insectivora). — *Mammalia* 38: 171—176.

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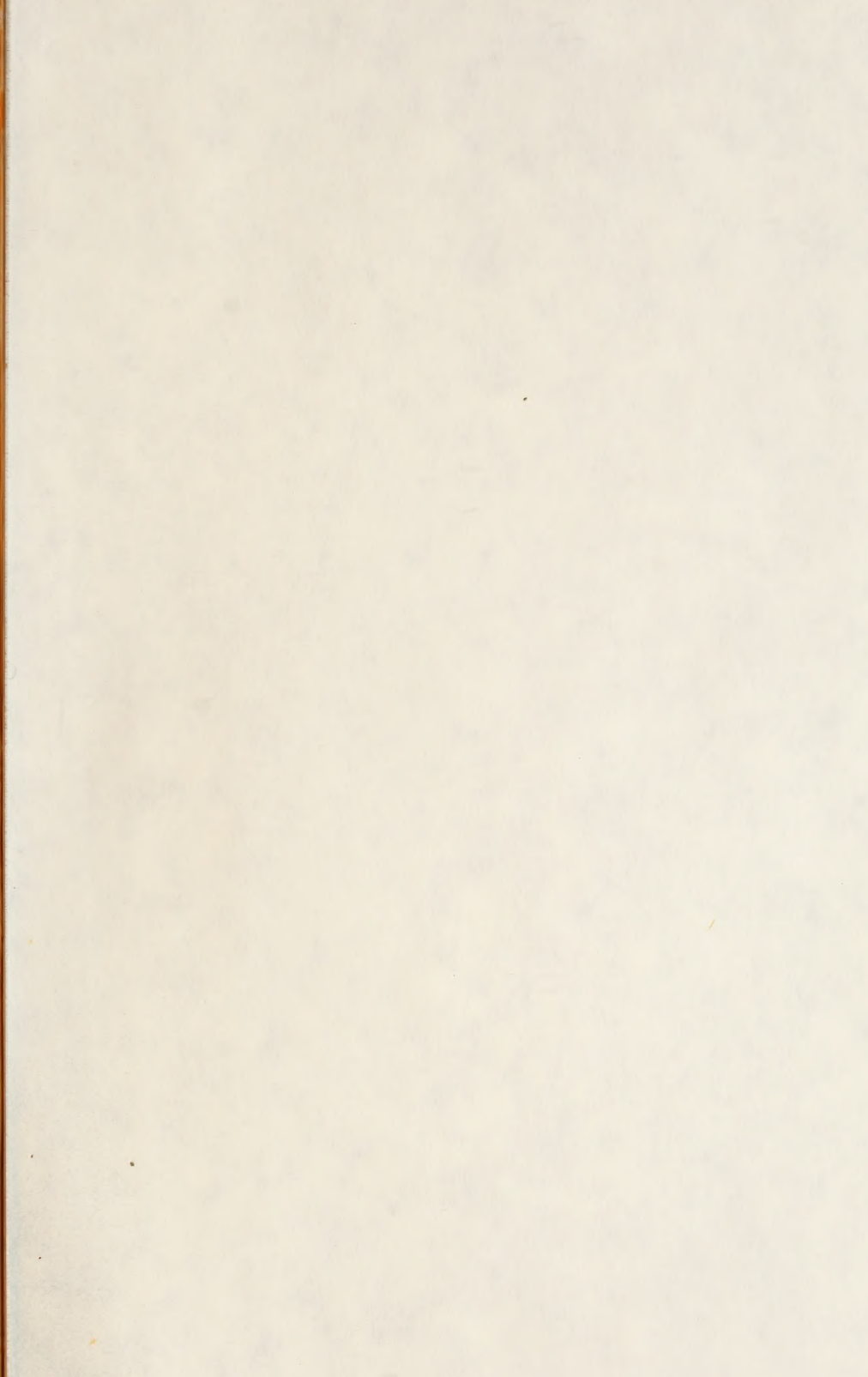
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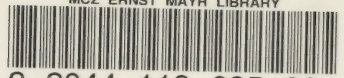








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